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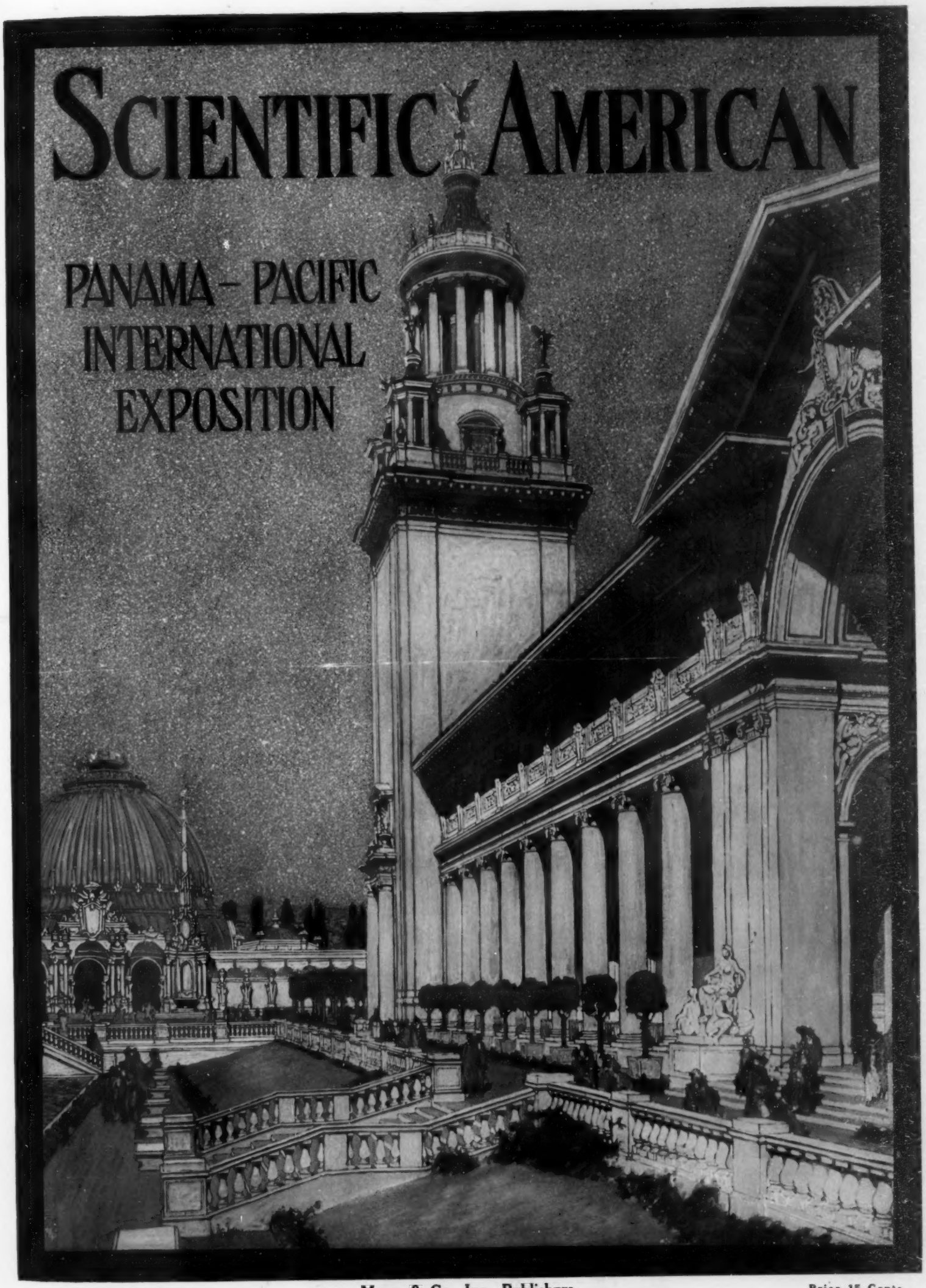
SCIENTIFIC AMERICAN

PANAMA-PACIFIC INTERNATIONAL EXPOSITION



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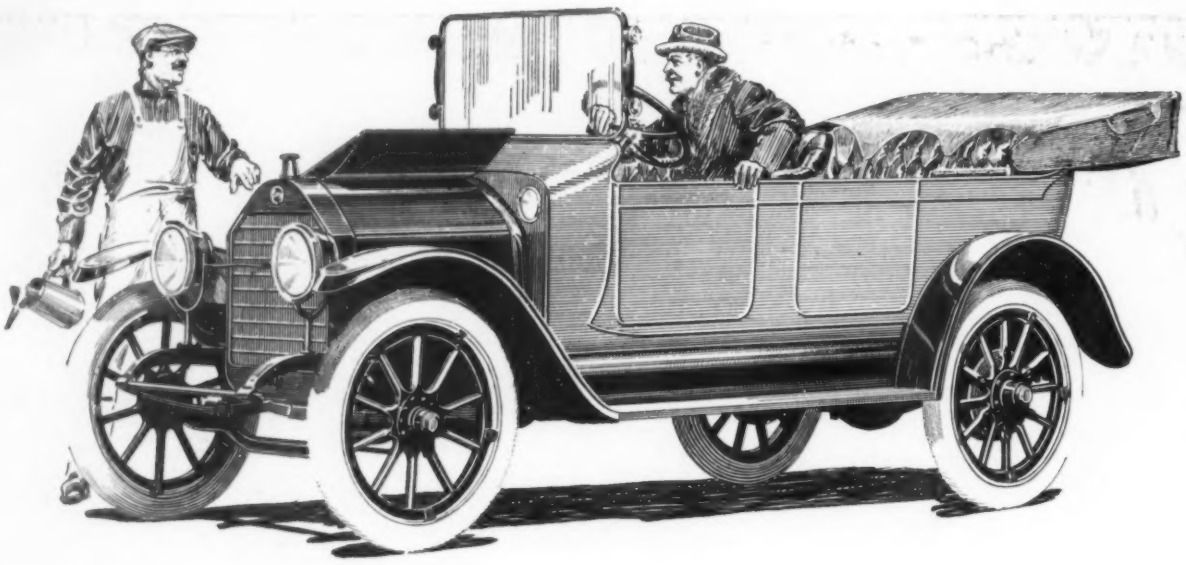


"You've got a fine car there!"

THE man who knows—the expert mechanic at your garage, will give you the most enthusiastic endorsement of the new Jeffery Four. When he says: "You've got a fine car there," it means a lot. He knows what to look for; he knows what there ought to be in a moderate priced car to make it really high grade.

The expert mechanic will tell you that he's been hoping that someone would do what we've done with the Jeffery, but he didn't expect it for another year. He'll back up our claims for the new Jeffery high speed mono-block motor. He knows that such a motor, the new European type, provides the only way to give you power and speed without heavy expense—that the days of the heavy motor is past.

Here is the lesson of the Paris show. Out of eighty-six exhibitors, fifty-two did not show a single model with as large a piston as is used in the Jeffery, light and compact as it is. The average European bore and stroke has been fixed at 3.1 by 5.5 inches. The Jeffery is 3¾ x 5¼.

The Jeffery Four at $1550 is the first high-grade car at a moderate price. It is the first car in its class to offer you speed, power, strength, reliability, economy, quality, and—above all, comfort.

The specifications are briefly stated below. Go over them with any expert mechanic. They tell the story. Send for the "Jeffery Circle." These points are covered there in more detail. They show where the big value comes in: where extraordinary quality is maintained.

USL starting and lighting, without chains, gears or belts. Imported annular ball-bearings. Speed it up to forty miles an hour, shut off your engine and coast half a mile.

Spicer universal joints, combination force feed and splash oiling system; four-speed transmission—the lightest and easiest to operate.

High-grade, full-floating type rear axle on imported annular ball-bearings—a delight to the mechanic.

Flexible leather coupling between clutch and transmission.

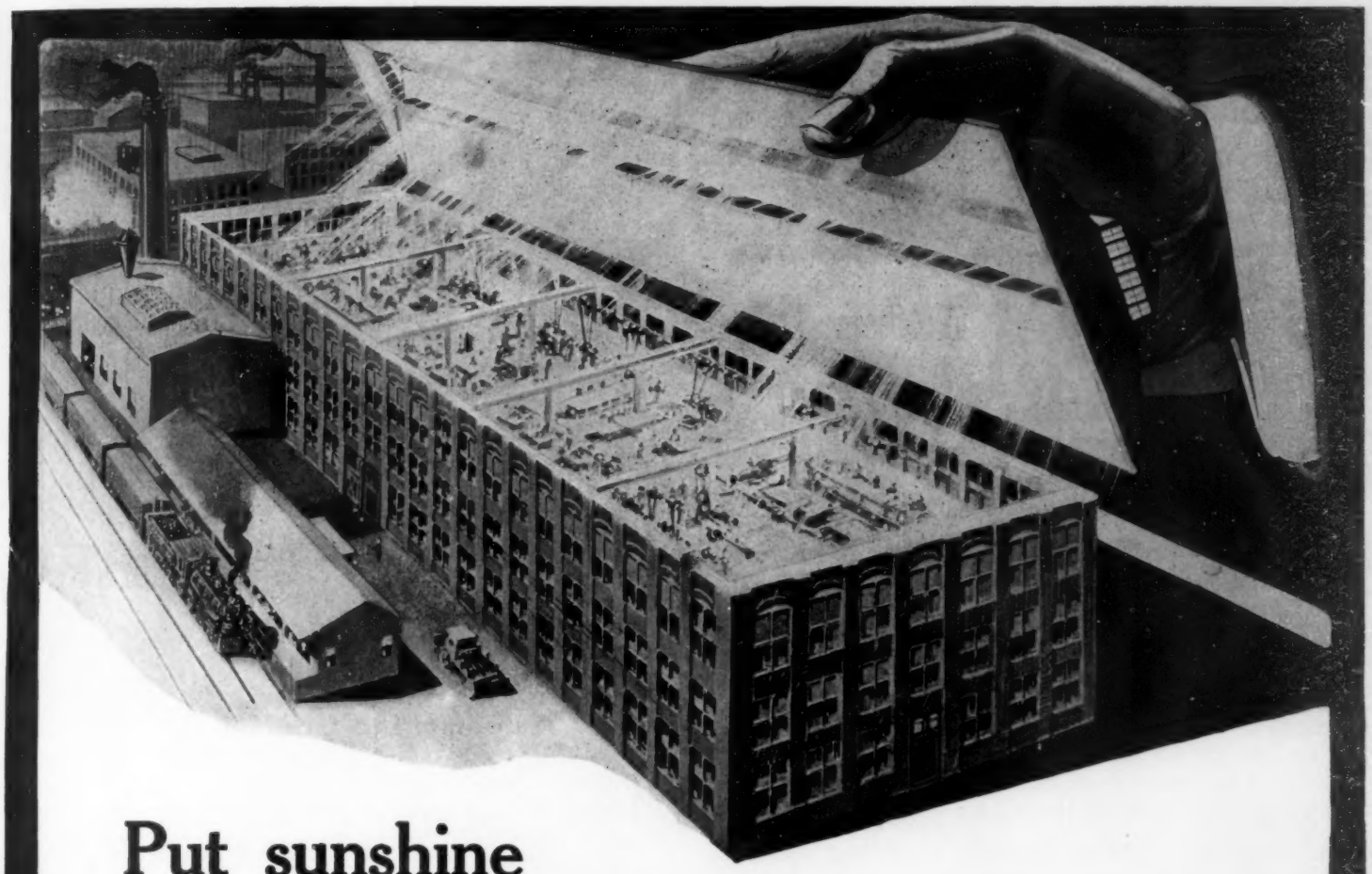
Vanadium steel in springs, rear axle drive shafts and front axle.

Rayfield carburetor; left drive and center control. Pressure-feed gasoline tank; pump operated through cam shaft. Bosch Duplex ignition. Solar lamps with dimmer, operated by four-position switch.

The Jeffery Four equipment includes Neverleak top, rain-vision windshield, Stewart-Warner speedometer, ammeter, extra demountable rim, with carrier; electrically lighted dash replete with latest attachments. Klaxon horn and complete tool equipment.

The Thomas B. Jeffery Company

Main Office and Works, Kenosha, Wisconsin



Put sunshine on your ceiling

Do the ceilings of your plant *reflect* or *absorb* light? It makes a difference which you can figure up in good dollars. A difference in your lighting bills, in the efficiency of your employees, in the quality of your product.

You want all the daylight you can get—every manufacturer does. *And you can get from 19 to 36 per cent more daylight*, the amount of the increase depending on the present condition of your ceilings and walls.

It is simply a matter of paint

Rice's Gloss Mill White Paint does not *absorb* a particle of light; it *reflects* all rays that come in through your windows down on to your machinery and into the dark corners of your plant. It will give you a smooth, glossy, tilelike surface, which will not scale off like a cold water paint; which will not crack or craze under the jar of machinery, which sheds dust, doesn't soil easily and can be washed like enamel.

RICE'S MILL WHITE

Is the only oil paint giving a glossy, tile-like finish without the use of varnish

It is economical to apply. It flows easily and evenly under a 4-inch brush. Its covering power and body make two coats equal three of lead and oil. It contains no lead or other poisonous substance, and *stays white longer than any other gloss paint.*

Rice's Mill White is an elastic oil paint affording all the advantages and none of the disadvantages of enamel. *It provides the highest illuminating power and the greatest sanitary value at the lowest ultimate cost.*

We were the originators of "Mill White" Paint. None of the many imitations on the market is made by the special RICE process. Not one of them possesses the elastic, permanent qualities which made the reputation of "Mill White" Paint.

Rice's Mill White Paint is sold direct from our factory in barrels containing sufficient paint to cover 20,000 square feet, one coat. If you have that area or more of ceiling and wall space to cover,

Rice's Granolith

A tough and elastic, permanent finish for concrete walls. Becomes a part of the cement to which it is applied. One coat sufficient, unless a gloss is desired. Makes the best possible primer on inside concrete and brick for a second coat of Rice's Mill White Paint, giving a tile-like, enamel finish at no more expense than lead and oil paint.

For Concrete Surfaces

Write for booklet and sample board.

Ask for a copy of our booklet, "More Light." Write today.

U. S. GUTTA PERCHA PAINT CO.

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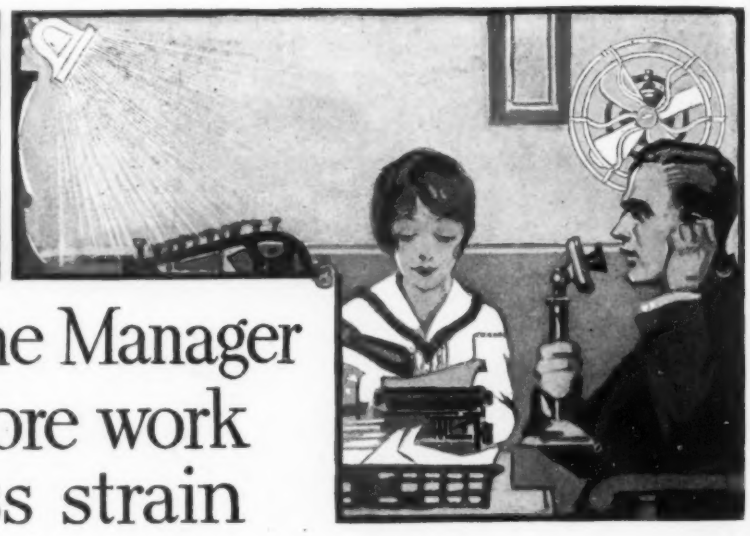

Helping the Manager to do more work with less strain

IT has been said that a regiment is simply a multiplication of its Colonel. The same thing is true of any kind of management. To multiply himself—to duplicate his own efficiency in every unit of his force—that is the manager's ideal.

So that a manager who is looking for 100% of efficiency in his force must first find it in himself. And to be fair to his force he must first be fair to himself. He must give himself all the chances of generating the fullest man-power.

The head of a sales division in a big western Indiana plant got hold of this idea and applied it with what he at first thought was some success. But he found himself working harder than ever, and the strain began to tell.

It was then that one of the directors happened to introduce a visiting electrical engineer who spent several days in company with the sales chief. By this time the engineer felt free to talk plainly.

"Mr. Blank," he said. "You're a splendid example of energy, but you're not giving yourself a square deal. You're not giving yourself the right help."

"The right help!" cried the manager. "Haven't I got a fine force here?"

"Your people are all right, and you've made them imitate your energy, but neither they nor you have the right help. You're all working, so to speak, with old-fashioned tools. The help you all want is electricity. Yes, I know you've got electric lights — old-fashioned ones in the wrong places. But there are at least twenty ways in which electricity could help you that you're not using—twenty more people would not help you so much and would only be an additional burden to you. Some day they're going to cut out all that overhead belting and shafting over there in the factory and use motor drive for each machine. Meanwhile you could apply that electric drive principle to the people in your office here. You could apply it to yourself. With the help of electricity you could do the same thing for this office that cutting out the overhead belting and shafting will do for the factory — make the general conditions better for all, and the particular conditions better for each.

"Let me show you what I mean — and your own case is most important, because if you are slowed down your force is likely to reflect you. Take your lighting. You yourself have poor light. You go after people or send after them, when a button in your desk would do the thing better and save hours of your high-priced time every week. A moment ago you got up and opened your window. A little electrical help here would purify that air fuel your human engines are stoking up on. You're not using electricity for any of the mailing or adding machines — and that clerk who is mounting photographs, for instance, could do it in one-quarter of the time with an electric flatiron. I venture to say that you could accomplish 80% more work here with half the wear and tear if you made use of electricity in even a fraction of the ways in which it can be used."

This plain talk fitted in so well with the sales manager's first thought on the efficiency question that he promptly acted on the detailed advice secured from the engineer, and supplemented by the local electric light and power company. As a result, within a year he was able to compute that without increasing his office charges by a single dollar he was doing much more work and found himself in a position to shorten his own too heavy hours.

Perhaps you who read this have a manpower problem in your own person. Take up the matter today with your electric power and light company or any General Electric Co. agent in your vicinity. You will find them more than glad to co-operate with you, and no matter how complex your problem may be they have at their command the service of any part of our organization that may be most helpful to them and to you.

The Guarantee of Excellence on Goods Electrical

Trade Mark

GENERAL ELECTRIC COMPANY

Largest Electrical Manufacturer in the World

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SIXTY-NINTH YEAR

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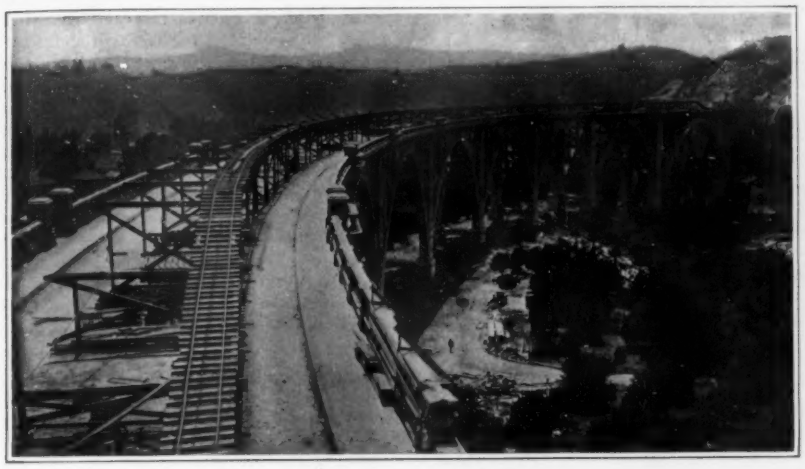


The bridge is built on a long, sweeping curve.

Pasadena's new concrete bridge.

Pasadena's Beautiful Bridge

Gracefulness of Line Achieved in a Work of Utility

THE huge concrete bridge at the head of Colorado Street, Pasadena, California, is the longest and highest bridge in the Southwest, and by all odds the most beautiful. The roadway is 160 feet above the channel of the Arroyo Seco, a stream flowing beneath the finest residential section of the city, and already highly improved. The nearly completed structure is quite in keeping with its beautiful surroundings, and the fact that it is built on a curve adds to its grace. The length is 1,468 feet, linking Colorado Avenue and a splendid boulevard by a roadway 28 feet between the curbs. This will be paved with asphalt and flanked by two five-foot sidewalks. No car tracks will cross this bridge, making it a perfect pleasure drive with wonderful views up the Arroyo to the mountains.

The most striking feature of the bridge, aside from its long, sweeping curve, is the series of noble arches, the largest of which is 223 feet from center to center of the piers, while there are two spans of 151 feet and six of 113 feet each. The arch spans consist of two continuous, elastic arch ribs, carrying spandrel columns and in part spandrel walls. These support cross beams with cantilevered ends. The massive piers rest upon the boulders and gravel of the stream bed and are tested to 11,000 pounds to the square foot.

Work has been in progress for more than a year, but a few weeks will see the completion of the important link in the California highway system. From 40 to 100 men have been constantly employed.

Cement to the extent of more than 10,000 barrels was required for the concrete, which is reinforced with corrugated bars of the strength of from 60,000 to 70,000 pounds.

The cost will be $200,000, half of which is borne by Los Angeles County and half by the city of Pasadena. The designers of the bridge are Messrs. Waddell & Harrington of Kansas City.

As the photographs indicate, unusual skill has been used in designing a graceful as well as a utilitarian structure; in fact, it is one of the few of this sort that can properly be classed as a work of art.

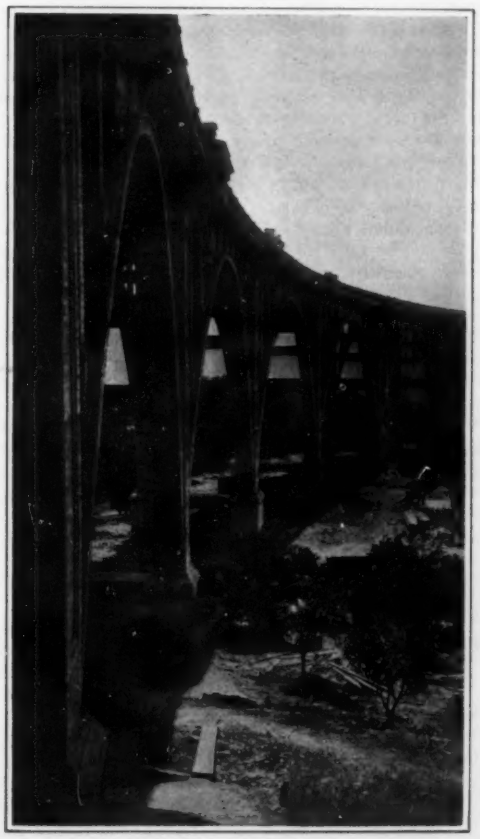
Flying in Fog and at Night

By C. Dienstbach

FIVE years ago an air pilot would ascend only after carefully studying the wind. A puffy breeze would so far intimidate him that he would not venture into the air. All that is changed now. Flying machines leap from the ground in all weathers. Fog alone seems a handicap.

In the German Kaiser maneuvers of 1912 the greatest confusion was occasioned by fog. Scouting both in the air and on land was completely paralyzed. But, given a machine that can fly slow and low, a machine that is reasonably noiseless, there seems to be no reason why fog should prove a serious embarrassment. Noiselessness can easily enough be attained with the aid of an efficient muffler. Whatever slight loss of power may be entailed by its use is compensated for by the ability to approach an enemy unobserved. Moreover, the muffler need be used only in the proximity of an enemy or when the crew wish to talk with each other.

Scouting in a fog very much resembles scouting at night, and night-flying is by no means unusual. Although a strong searchlight must be used to make nocturnal flying possible, the nocturnal scout should nevertheless be able to perform effective work. The searchlights need be flashed only at intervals sufficiently numerous to guide the aviator. Thus used, it may even confuse and demoralize an enemy. It certainly does not betray the location of the shifting air scout. So a muffler may be used intermittently with like effect in a fog.



The beauty of the bridge ranks it as a work of art.

A flying machine that vanishes in silence and darkness and is heard or seen only at fitful moments can be safely used at night or in a fog. But the machine must fly low. To fly low it must be very stable, because the wind is usually much disturbed near the ground. Many inventors are now engaged in making the aeroplane stable and safe, so that civilians will not be afraid to use it. The principal military significance of these promised improvements lies in the fact that they will make low flying possible. For war at least the unsafeness of the early aeroplane was not prohibitive. Soldiers expect to risk their lives, whether it be in the air or on the battlefield. But even the war aviator demands more of a machine than could be fulfilled by the aeroplane of 1908. Above all things he demands stability, not so much because stability means safety as because it means the possibility of flying low.

Build a machine which is capable of skirting the ground and the aeroplane becomes hundreds of times more efficient than a body of cavalry—more efficient in the ability to find its way, more efficient in seeing things in detail, and more efficient in doing service at night and in fog.

Low-flying, however, means not merely stability, but also a reliable motor. Even now the risk of a breakdown is less than the danger from bullets. There is no choice of a landing place in case of a breakdown. Hence, the motor must be dependable. Some day we will have a machine in which the engine will be all that the military aviator can desire.

To Our Subscribers

WE are at the close of another year—the sixty-ninth of the SCIENTIFIC AMERICAN's life. Since the subscription of many a subscriber expires, it will not be amiss to call attention to the fact that the sending of the paper will be discontinued if the subscription be not renewed. In order to avoid any interruption in the receipt of the paper, subscriptions should be renewed before the publication of the first issue of the new year.

To those who are not familiar with the SCIENTIFIC AMERICAN SUPPLEMENT a word may not be out of place. The SCIENTIFIC AMERICAN SUPPLEMENT contains articles too long for insertion in the SCIENTIFIC AMERICAN, as well as translations from foreign periodicals, the information contained in which would otherwise be inaccessible. By taking the SCIENTIFIC AMERICAN and SUPPLEMENT the subscriber receives the benefit of a reduction in the subscription price.

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Munn & Co., Inc., 361 Broadway, New York

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

Lifeboats on Lake Steamers

SWEEPING legislation that fails to take note of local conditions and other modifying circumstances, is greatly to be deprecated: for it may frequently secure a trifling amount of theoretical good at the cost of a large amount of disastrous harm. A case in point is a bill which is now before Congress, under which the passenger steamers on inland waters would be required to carry sufficient lifeboats to accommodate everyone on board and two able seamen for each boat. It is contended by the Great Lakes shipping people that, if this bill becomes law, the ships will be so lumbered up with lifeboats and so crowded with able seamen, that passenger-carrying capacity will be cut down to such a small figure as to render the ships altogether unprofitable, and drive many of them entirely out of service.

As illustrating how this able seamen and lifeboat provision works out on one of the modern lake ships, we present the following facts: A lake passenger steamer, with a carrying capacity of 3,000 people, such, let us say, as the ship recently illustrated in these columns, carries a minimum crew of 180, all of which crew is regularly drilled in the handling of lifeboats, fire protection apparatus, and so forth. Her life-saving equipment consists of eighteen 30-person lifeboats, thirty-four 15-person liferafts, and 3,500 life preservers, besides other miscellaneous equipment. Under the proposed bill, for the same number of passengers, this ship would be required to carry 115 thirty-person lifeboats and an additional crew of over 200 men known as able seamen; and these men would have nothing whatever to do except handle the oars of a lifeboat in case of disaster. The extra men required could not be provided with quarters, except in the passenger department, and because of the great reduction in the passenger carrying capacity, due to this invasion of the passenger quarters by the crew, and the great additional expense, it does not take the eye of a shipping man to see that the chance of such a vessel earning her dividends would be very remote.

Now no one who is familiar with our columns will accuse the SCIENTIFIC AMERICAN of wishing to call a halt on the present praiseworthy efforts to make passenger ship travel as safe as the circumstances of the case will permit. We believe, however, that the best lifeboat is the ship itself, which, by proper subdivision of her hull and precaution against fire, may be made so safe against any but the most extraordinary of disasters, that passenger travel by water shall not only compare favorably, but shall be superior in the matter of safety to any other means of transportation.

However safe a ship may be rendered by subdivision and other well known means, it will be always necessary to carry a certain number of lifeboats. But we believe that in this matter good judgment should be used, and the number of boats in proportion to passengers carried should be regulated according to the conditions under which any particular steamship service is carried on. No one would think for a moment of demanding that boats shall be provided on the Hudson River steamers in sufficient numbers to carry every passenger on board. The proximity of these steamers to the shore on either hand renders such precaution unnecessary. Conditions in coast and lake service demand that the number of lifeboats should be increased; but even here we believe that the question of lifeboat accommodation should have a distinct relation to the nearness of the coast lines to the steamer route. It should be determined, also, by the extent to which the hull of the ship is safeguarded against sinking by subdivision with bulkheads.

Goethals on the Panama Canal

WE have before us the annual report of Col. George Goethals, Chairman and Chief Engineer of the Canal Commission, which has recently been submitted to Secretary of War Garrison. It is significant that no definite date is set for the official opening; nor is there any precise prediction as to when ships will make their first passage from ocean to ocean. In the early days of canal construction, it was thought that the building of the massive monolithic locks would be the determining factor in the question of the time of opening; as indeed it might have been but for the development of slides in the Culebra cut.

The report states that the canal proper, if we exclude the approaches, machine shops, warehouses and the large ocean docks at each end, would have been completed during the last fiscal year, had it not been for the totally unexpected magnitude of the Culebra slides. As for these, no effective way was found to deal with them, except by bodily removal of practically vast hills of material. Furthermore, the slides and breaks in the banks increased in severity as the cut went down. It was found that the only effective way to deal with this stupendous problem was to excavate and haul away the material from the moving mass, until the slides came to rest, or until the angle of repose for the particular material in motion was reached.

Col. Goethals draws attention to the fact that it was predicted last year by geologists that the slides had been conquered, and that because practically all the loose surface soil and stone had slid off, exposing great ridges of solid basalt rock, this last material would act as a barrier to further earth movement. Nevertheless, when all was most promising and the canal excavation was within sixty feet of the bottom of the cut on the east side, the rocks broke under the enormous overhead pressure, and 2,000,000 cubic yards of material moved into the excavation and closed up the cut. The mass was attacked by giant dredges working on the face of the slide; and powerful hydraulic monitors, similar to those extensively used in hydraulic mining on the Pacific Coast, were brought into play to wash away the hill from the rear and carry the material into unused valleys at a distance from the canal.

It is explained that water was admitted to Culebra cut under the belief that the effect of the water in the cut would be to retard the slides, an expectation which was justified by experience obtained below the Gatun locks. The geologists, on the other hand, thought the water might to some extent develop new slides. Furthermore, in 1909, there was much speculation as to the effect of the seamy character of rock on the Isthmus, and it was predicted in some quarters that there might be a leakage of the Gatun Lake through seams and crevices. If these things are liable to occur, says Col. Goethals, the sooner the better, if the official opening of the canal is to occur January 1st, 1915; for if the water had not been admitted this fall, but had been deferred until May 1st, 1914, the full height would not be reached until October, 1914, and this would leave little time for the determination of these questions. Hence it was decided to admit the water at the earliest possible date for getting the dredges into the cut and at work on the slides.

It is gratifying to learn from the report that the mechanism of the locks and dams has been tested with perfect success. The gates at Gatun were swung in one minute and fifty-one seconds time for each. The massive fender chains, whose duty it will be to prevent a vessel which has got away from control from crashing into the locks, were raised and lowered in plenty of time to meet any emergency of this kind. They demonstrated that they could check or actually stop any vessel, unless she happened to be of very great size and moving at excessive speed. The electric towing locomotives which will handle the ships in the locks proved their ability to easily tow the largest vessels. A successful test has also been made of the electric installation.

On the Unpopularity of Truth

A RECENT editorial in these columns on "Chimerical Weather Forecasting" has elicited from one of our readers an appreciative letter, extracts from which appear elsewhere in this issue. Our correspondent asks for another article on the same subject, warning him in no uncertain way "as to the schemes of frauds and unreliable persons who would fool the public, and especially the farmers."

Certainly it is one of the functions of a didactic journal to expose both shams and errors; even though the task is apt to be an exceedingly discouraging one. The public is proverbially fond of being deluded and of deluding itself, and there are many frauds and fallacies that seem to be endowed with Antæus's faculty of rising up refreshed and reinvigorated after every knockdown they receive at the hands of whoever champions the cause of truth and common sense.

Not long ago we suppressed an ardent desire to pay our respects editorially to a certain large class of American newspapers anent the faults to which these publications are addicted in their treatment of scientific questions—such, for example, as the arrant nonsense printed under the guise of "science" in the Sunday supplement; garbled interviews with scientific worthies; and the inadequate and inaccurate record of scientific occurrences in the news columns. One reason for not indulging this desire was the consciousness of our own liability to error, and the feeling that in such matters example is better than precept. A more cogent reason, however, was the conviction that the newspapers are very accurately adjusted to the demands of their readers, and that improvements in the matters just referred to will come to pass automatically as soon as the public evinces a genuine desire for them.

An interesting subject of inquiry would be this: Whether shams in literature and shoeblacking were one whit abated by Thomas Carlyle's diatribes concerning them? Or, again: Whether any process less drastic than a surgical operation would eliminate from the mind of the average man the belief that the weather is regulated by the moon?

The Origin and Evolution of Man

THE subject of the age of the human race has an unfailing interest for all thinking people, an interest which the discovery, in the spring of the present year, of the now famous Piltdown skull has served greatly to stimulate. Every such relic brings its own message from ages hitherto considered to be so far removed as to antedate the appearance of man. The message, however, is written in terms so difficult to decipher that only a gifted few can read it with any approach to the truth.

It gives the SCIENTIFIC AMERICAN much pleasure to present in this issue an article by one of the men who have made a life-study of this question. Dr. J. Leon Williams, who has been made a Fellow of the Anthropological Institute of Great Britain and Ireland in recognition of his contributions to this particular branch of science, has summed up the arguments for the great antiquity of man, which have been based upon the more recent discoveries of human relics of amazing but clearly proved antiquity. Although he has been quoted (too often erroneously) in the daily press, the article referred to is his first public pronouncement in the United States. Dr. Williams is arranging to give one or more lectures before our universities and scientific societies, in which he will set forth the arguments by which he arrives at the conclusion that man has been in existence on this planet for at least five hundred thousand years.

Sir Robert Ball

OUR astronomical readers will have noted with regret the death, at the age of seventy-three years, of Sir Robert Ball.

Born in Dublin in 1840, Robert Ball graduated in mathematics from Trinity College, Dublin, and was appointed astronomer to Earl Rosse in 1865. Two years later he accepted the professorship in applied mathematics at the College of Science of Ireland, and later he received a similar appointment from his alma mater. In 1874 he was made Astronomer Royal of Ireland, and in 1892 director of the Cambridge Observatory, England.

Sir Robert Ball was very friendly to America, and showed his appreciation of our educational institutions by sending one of his sons to the Massachusetts Institute of Technology.

Of his works those perhaps best known to our readers are his popular writings, such as "The Story of the Heavens," "The Time and Tide," "Starland," etc. But these represent merely a by-product of a mind whose main activities were consumed in highly technical activities.

Student Labor in Public Works.—According to a bulletin of the Bureau of Education, boys in the Ishpeming (Mich.) high school repair the school buildings for pay, conduct a co-operative school farm for profit, and are about to erect a gymnasium for their own use from plans drawn by high school seniors. All this work is done under the direct supervision of the school authorities. Students from the manual training department of the high school are regularly employed in work on school buildings, repairing roofs, laying cement floors, building brick walls, and installing plumbing fixtures. During one summer $3,000 was thus paid for student labor.

Electricity

Transatlantic Wireless Telephony.—The daily press recently reported that William Marconi had succeeded in sending wireless telephone messages across the Atlantic. However, Mr. Marconi has denied the report, but admits that important experiments are now being carried on and expects that before long such a feat will be accomplished. Up to the present he has not succeeded in telephoning by wireless more than 200 or 300 miles.

The New German Field Searchlight hangs at the end of a telescoping mast which in the horizontal position is short, but as the mast swings in trunnions it can be swung to the vertical by turning a crank, while another crank causes the mast to lengthen out by withdrawing the several tube sections. This puts the searchlight at a high point in the air which is excellent for directing the beam around the horizon. All the operations are quickly carried out.

Ultra-violet Rays Not Emitted by Electric Lamps.—In refuting a newspaper report that "incandescent gas was less hurtful to the eyesight than the electric light on account of the ultra-violet rays of the latter," an English electrical periodical reiterates the fact that since glass of all kinds is opaque to these rays no form of incandescent electric lamp having a glass bulb can emit these rays, nor can any arc lamp or mercury vapor lamp in which the light source is inclosed in an envelope of the ray-filtering glass.

Up-to-date Foreign Testimony on American Telephone Service.—A member of the British Parliament who has made some study of the telephone services in Chicago, Seattle, New York city, and Canada, stated recently that they were distinctly more efficient than the telephone service in his country; although not more efficient, he believed, than the latter would be. England was ahead of the United States in the development of the automatic telephone service, and contracts for automatic exchanges of the total value of nearly half a million dollars were being placed.

Burglars' Microphone.—The microphone is now used by burglars for picking combination locks. On turning the lock a slight sound is made when the proper number comes opposite the working point, and this can even be heard by a sensitive ear. However, it is imperceptible to most persons, but by using a microphone it is an easy matter to hear the sounds. A suitable form of flat telephone receiver is employed, and it is applied against the safe next the lock. A pair of rubber ear tubes are used with the telephone. In this way the sounds are heard which allow of opening the lock.

An Advantage of Turbine-electric Marine Propulsion.—The steam turbine shows its highest efficiency at a high speed of rotation, whereas the marine propeller must be driven at a rather low speed. The problem in efficient marine propulsion by the turbine is therefore how to combine a high speed turbine with a low speed propeller. Two methods of delivering the power of the turbine at reduced speed have been developed: reduction gearing between turbine shaft and propeller shaft, and an electric generator driven by the turbine and supplying electric motors on the propeller shaft. An English contemporary points out that although the former solution has been the most widely adopted, it is at the disadvantage that the main power can not be reversed, and special turbines must be installed for maneuvering the ship, whereas by the electrical method the entire power delivered by the turbine can be reversed at the propellers.

Time Signals From Eiffel Tower.—It has now been definitely decided that the Eiffel Tower shall be used as the center for the world time distribution scheme. The members of the Time Conference held at Paris recently adopted the statutes of the International Association, and fifteen governments have adhered to these statutes, it being expected that other states will follow before long. The new association is situated in Paris and the wireless signals will go out from the Tower twice a day at the determined hours, this corresponding to the Greenwich meridian as corrected by observations sent here by astronomers the world over. The posts all over the globe will receive the time signals and will then transmit them within their own range, so that in a very short space of time the hour will be known within one-hundreth of a second. Ships at sea which receive the signals will know their bearings within thirty feet. The Tower will be "internationalized" for ten or twelve minutes every twelve hours, or during the time needed for the operations of the international bureau, and during this time it cannot be made use of for any other service, even for the government. The choice of the Tower was made because it is the best fitted for the purpose among existing stations. It is true that the Norddeich post which is being constructed at the present time in Germany is expected to have a higher power than the French plant, but it is also probable that the latter will be increased in power in the course of time so as to maintain its present leading position.

Science

Monument to Laplace.—Subscriptions are being collected throughout the world toward the erection of a monument to the author of the "Mécanique céleste" in the town where he was born, Beaumont-en-Auge, France, and toward restoring his tomb. Remittances may be addressed to M. Leprince, avocat, Beaumont-en-Auge, Calvados, France.

Cattle for Alaska.—Special Agent Georgeson, in charge of the agricultural experiment stations in Alaska, is trying to persuade the Government to undertake an interesting breeding experiment with a view to obtaining a race of cattle suited to the rigorous climate of that territory. His plan is to cross the yak—the domestic ox of Tibet—with Galloway cows.

Prof. Henrik Mohn has retired from the professorship of meteorology at the University of Christiania and the directorship of the national meteorological service of Norway. He is succeeded by Aksel S. Steen. Prof. Mohn, who was born in 1835, has long been the dean of the International Meteorological Committee, and is one of the most distinguished and revered of European scientific men.

A New British Antarctic Expedition is being organized by J. Foster Stackhouse, a well-known English traveler and geographer. The expedition is expected to sail from England in the steam yacht "Polaris" in August, 1914, and to spend two years in an exploration of King Edward VII. Land, the region east of the Ross Barrier discovered by Capt. Scott during his first journey to the Antarctic.

The Ventilation of Motion Picture Theaters urgently demands attention in most of our cities. In Chicago, which has about 600 of these institutions, with a daily attendance of about 500,000, the Department of Health has adopted the plan of issuing certificates to all theaters having ventilation systems of proved efficiency, and urging the public to patronize no theaters where these certificates are not displayed. Let us hope the next object of attack will be the hermetically sealed street-car!

A Rainbow Seen Long After Sunset is described by M. Durand-Gréville, in *L'Astronomie*. It was seen by L. P. Mermod at Sainte-Croix, in the Swiss Alps, spanning a valley between two mountains to the eastward, and from a sketch furnished by the observer appears to have been a secondary bow, as fragments of another bow (apparently not a "supernumerary") were seen inside it. A complete and brilliant arc was first seen 25 minutes after the astronomical sunset (on September 10th), and portions of the bow were still visible half an hour later.

International Scientific Congresses.—*Petermann's Mitteilungen* has published a symposium of opinions from eminent geographers concerning the advisability of making radical reforms in the character and organization of the international geographical congresses, and many of the remarks thus elicited probably apply to scientific congresses and conventions generally. The writers are nearly unanimous in recommending that these meetings should hereafter be smaller, less conspicuous, and more strictly professional. Heretofore the professional geographers attending the congresses have been more or less lost in a crowd of irrelevant persons, such as diplomats, pleasure travelers, local officials, and dilettanti. One of the greatest benefits such meetings should confer—viz., intimate social intercourse between serious students—is largely nullified by the formal character and overgrown size of the usual banquets, receptions, and the like. The root of the evil seems to be the conventional idea that international congresses should be carried out on an elaborate and expensive scale; in order to raise the necessary funds the organizing committee is obliged to swell the membership as much as possible, and the scientific flavor of the meeting is diluted in a corresponding ratio.

The Pilgrimage to Mecca is still a standing menace to the health of the world, in spite of the sanitary precautions adopted by the various countries concerned, including the Ottoman Empire. The American consul general at Constantinople quotes statistics collected by the Turkish Sanitary Administration concerning the number of pilgrims who traveled to Mecca *via* ports of the Red Sea during 1912. There were 83,995 of these, most of whom came by way of Jeddah, and of this number 44,671 had to be subjected to quarantine or other sanitary measures. Statistics of those arriving by the Hedjaz Railway and other overland routes are not given, but it is known that the annual number of pilgrims often exceeds 100,000. In 1912, 198 vessels were engaged in carrying pilgrims, of which 134 were British, 22 Russian, 13 Dutch, and 29 Ottoman. As to the origin of the pilgrims, the largest number came from the Far and Middle East, including 15,000 from Bombay, 9,500 from Singapore, and 12,000 from Batavia. From the Indian Ocean, Gulf of Oman, and Persian Gulf regions came 4,823; from the Arabian and African coasts of the Red Sea, 22,108; and from ports on the Mediterranean, 6,741. Finally three Russian ports contributed 10,473, of whom 7,692 came from Sebastopol.

Aeronautics

Closing of Contest for $100,000 Prize for a Safe Aeroplane.—Entries close on January 1st for the big prize of 500,000 francs offered by the Union pour la Securité en Aeroplane for the best device attached to a heavier-than-air machine which will promote safety in flight or in alighting, or for the aeroplane as a whole which is considered the safest machine. This prize was announced last summer, and it is the biggest prize yet offered for the development of the safe aeroplane. Inventors will not be required to demonstrate their machines or devices for a couple of months after the closing date of entries. An entrance fee of $40 is required, together with a complete description of the apparatus and an option in favor of the French government for the period of a few months. Entry blanks and further particulars may be obtained by addressing the Aeronautic Editor of this journal.

Latest Results of the Aeroplane in Warfare.—Early last month the aeroplane was used with success by the Spaniards in Morocco and saved a detachment of cavalry that was attacked by a large force of natives near Ceuta. The cavalry was getting the worst of it when the Infante Alfonso chanced to arrive overhead in his aeroplane, accompanied by other members of the aerial squadron. The Moors were so terrified that they fled and allowed the survivors of the battle to escape with their wounded. On November 20th, while Lieut. Gil Rios and Capt. Barreiero were flying over the enemy's camp near Tetuan, Morocco, they were hit and severely wounded, but were able to get back to camp and alight. Lieut. Gil Rios was struck by two bullets, while his passenger received one. The height at which they were flying was not stated, but anything less than 5,000 feet is not considered a safe elevation in time of war. On November 23rd, as the cruiser "South Dakota" entered the Golden Gate, Silas Christofferson flew over her and dropped a sand "bomb" which struck her amidships. This is the first time, so far as we know, that an aviator has succeeded in dropping a bomb on a moving warship.

Progress of the Paris-Cairo Flight.—Pierre Daucourt, the French aviator who is making a long-distance flight from Paris to Cairo, Egypt, arrived at Constantinople on November 9th. He started again on the 15th, and reached Konieh, Asia Minor, on November 24th. Two days later he was overtaken by a storm in the Taurus Mountains and his aeroplane was wrecked while making a landing, though fortunately neither he nor his passenger, M. Roux, were injured. He left Paris on October 21st and hopes to reach his destination before Christmas. Another aviator who is attempting a record-breaking flight is Jules Vedrines. On the 20th ult. he flew from Nancy, in France, to Prague, Austria, a distance of about 500 miles, without once descending on German soil. He is planning to fly to Australia *via* Constantinople, Egypt, the Soudan, and Lake Tchad, or, if this route is found to be impracticable, *via* Asia to the island of Ceylon, and thence to Australia. In view of what Vedrines and Daucourt have already accomplished in this line, and also of Gilbert's wonderful flight of 650 miles across country recently at the rate of 124 miles an hour, it would seem as though the circumnavigation of the globe by aeroplane may yet be accomplished.

Flying Upside Down and "Looping the Loop."—Spurred on by the accomplishments of Pégoud, a number of prominent flyers in France, England, and America have lately been imitating this daring Frenchman. On the 15th ult., at Versailles, Hanouille flew upside down for 20 seconds and "looped the loop" twice in quick succession. The English aviator, Hucks, surpassed him in his Blériot by remaining inverted 35 seconds and making four consecutive loops. On November 18th Chevillard, with his Farman biplane, "looped the loop" twice with a passenger, and subsequently he turned over sideways while flying along in a straight line, thereby performing a sort of cork-screw twist. On the 21st ult., Chanteloup did three vertical circles in a high wind and, dropping from a height of 2,000 feet like a plummet, he righted his machine within 70 feet of the ground. H. Lee Temple flew upside down at Hendon, England, for a short distance on November 24th, and two days later B. C. Hucks made six circles in a vertical plane while descending from a height of 2,000 feet. Lincoln Beachy, at San Diego, Cal., "looped the loop" twice on the 25th ult., starting from a height of 2,500 feet, and on Thanksgiving Day he made three such circles while descending from a slightly greater elevation. A French aviator recently had his aeroplane turn turtle while 1,500 feet in the air. As he was strapped in, he kept his seat during the descent, in the course of which the aeroplane described several loops. By keeping his nerve, he managed to regain control and to land in safety. Pégoud has made as many as ten loops in a single descent and has flown inverted for over $1\frac{3}{4}$ minutes. He has done great good by showing the flying fraternity that all is not lost when the machine capsizes in mid-air.

The Enlargement of Sculpture

The Pointing Machine With Which the Sculpture at the Panama-Pacific Exposition is Being Enlarged Under the Direction of the Inventor of the Apparatus

By Jay Hollingsworth

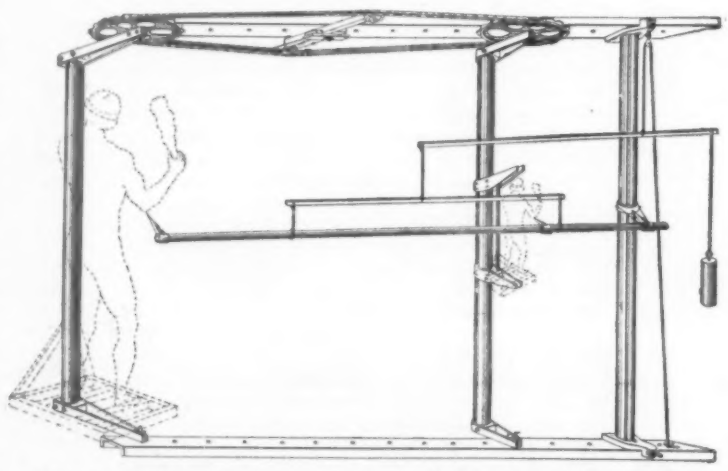
IN very early times the number of sculptural types was so limited that there was really no need for the sculptor to make a model in clay before beginning to carve a statue in stone or marble. Such variation as he might introduce into his work was rather in the study of detail than in the general conformation of the figure; and although he may often have made a sketch in clay of what he had observed in nature, there is no reason to suppose that he worked this into a full-sized and complete clay model before he began cutting into the block of marble. When we come to the period of artistic freedom the conditions are altered. Then it seems most likely that the sculptor embodied his first conception of a work of art in clay or wax, but that he cut the marble more or less free hand.

The confidence and freedom given to an ancient sculptor by the force of tradition, hereditary skill, and training, as well as by the constant observation of the living and moving human form in the palæstra and elsewhere, gave him a great advantage over the modern artist who is mainly dependent on the study of posed models. Moreover it was easy to obtain the finest marble so that if a block or two were spoiled it did not so much matter. It seems likely that the Greek sculptors of the finest period of art often worked freely in marble, and it is recorded that Michael Angelo often did so.

In times when genius and inspiration were less frequent, and art was more a matter of academic study we find that the use of finished models became as universal as it is at the present day—that the form of the full-sized model was transferred to marble by the same mechanical process still in use, and that the method of enlargement was the same laborious method in common use until displaced about ten years ago by the time-saving pointing machine, devised so as to do its work with mathematical precision.

By whatever method, the copying of a model of a statue on a larger scale is done by measured points on the surface, hence it is called "Pointing" by sculptors. Points most salient and helpful to the eye in best tracing the form are selected—the time, the seriousness and finish of the work in hand determining the number of points so measured. From time immemorial this work, whether in carving or in building up models in plastic materials for modeling, has been done with dividers and calipers of different shapes and sizes convenient for the measurements to be made. The process of measuring points by this means requires much time, care and skill, and is at best only approximate.

First a series of points, a dozen or so in number, convenient for outlining the general form of the figure or group are selected as bases of measurement and marked on the plaster model each by a tiny nail with a fine dent pricked in the head for receiving the point of the dividers. Minutest care must be exercised in placing these "master points" and in finding their corresponding points in the enlarged figure, as the exactness of all the measurements depends upon their accuracy. The first point on the enlarged figure is placed arbitrarily, the second by one measurement, the third by two measurements. These three points determine a triangle similar to the one whose vertices were the three master points on the model. That is, if the enlarged figure is to be twice the height of the model, each line connecting two surface points (sides of triangle) on the enlarged figure should be twice as long as that connecting the two corresponding points on the model. After the three points are determined, three measurements are required to locate the fourth as well as all remaining points. Further it is desirable that the fourth point be so taken that any two of the three lines connecting it with master points should be at about right angles. With this in view the skillful pointer so places his master points that any point on the surface of the figure or group can be commanded by measurements from three master points—lines to which make three approximately right angles. Of course to measure all points is impossible, but enough are taken to give a general outline of the surface of the enlarged figure.



How the model and enlargement are mounted on the pointing machine.

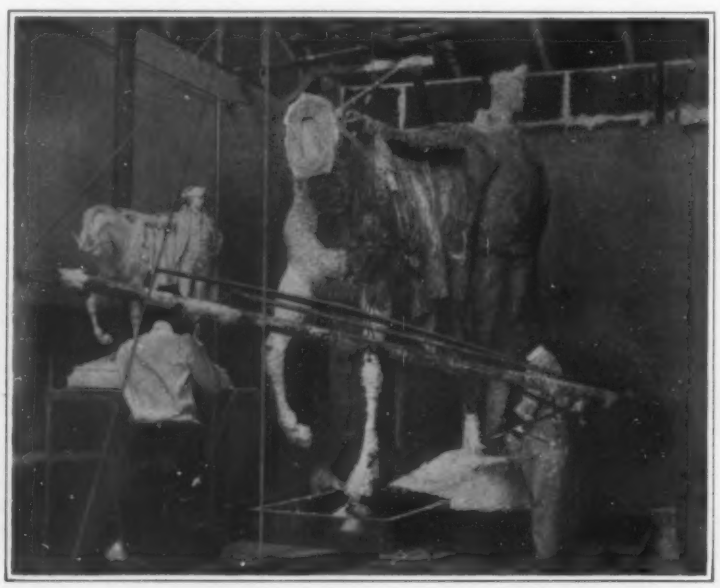
To render measurements from the model into measurements on the enlarged figure, sculptors use a "scale" made in one or another of several ways, all of which employ the principle of similar triangles. The one most commonly in use before the whole method was displaced by the pointing machine was a right angled triangle in which the hypothenuse was the height H of the enlarged figure, and one side h the height of the model. Measurements on the model will then be taken on lines parallel to h, and the corresponding hypothenuse of the smaller triangle will be the desired measurement on the enlargement.

It is said that a brass plate presumably a "scale" is still to be found on the base of the Egyptian Sphinx on which are drawn similar triangles. This would indicate that the method of enlargement, until so recently in use, is as old as the most ancient sculpture. But the marvel is that so laborious a method and one admitting of so much error could have persisted so late in this age of scientific method.

The pointing machine as shown in the picture has a movable shaft one end of which is always on a fixed point (at the right in the drawing). Attached to this shaft are two movable arms each ending in a sharp

(Concluded on page 444.)

Building up the clay core for the enlargement.



Using the machine to locate points on the enlargement corresponding to the clay model.

The armature ready for the clay core.

California Asphaltum Deposits and Methods of Mining

By Elizabeth A. Ward

Photo. by G. G. McLean, Carpenteria, Cal.

Recently opened mine of soft asphaltum at Carpenteria, California, showing a part of the deposit stripped of soil, and the depth both of soil and deposit.

THE asphaltum deposits of California are confined to a narrow strip of territory near the coast and extend, broadly speaking, from San Francisco on the north to Los Angeles on the south. They consist either of sandstone impregnated with bitumen, or of asphaltic oil mixed with sand. In common parlance, the former is hard asphaltum, the latter soft, a condition due in the one instance to loss of volatiles and to their retention in the other. By far the greater part of California asphaltum, aside from her extensive fields of asphaltic oil, is in the form of bituminous rock and the percentage of pure asphaltum is remarkably uniform, averaging from fifteen to twenty per cent. Geologically, they belong with one exception to the Miocene epoch. In all this five-hundred-mile extent containing large areas of bituminous deposits hardly more than half a dozen districts have been opened up for mining on a commercial scale and the product has been utilized almost entirely for local needs.

The districts where the greater part of the mining has been done are Santa Cruz, about fifty miles south of San Francisco; San Luis Obispo, two hundred miles farther south; and several different sections of Santa Barbara County, a hundred miles on down the coast. Ventura and Los Angeles counties contain large fields of asphaltic oil, and the same is true of a large area in Kern County, but asphaltum in the common acceptance of the term does not occur here to any large extent and very little mining has been attempted.

The Santa Cruz deposit, situated eight miles west of the city of Santa Cruz, covers an area of five or six square miles and was opened up thirty-five or forty years ago. It occurs in a marked belt about fifty feet thick at an altitude of eight or nine hundred feet near the top of Empire Ridge. This outcropping is covered by from fifty to one hundred feet of diatomaceous shale, and it is of a dull gray color, the result of fading through long exposure to the elements. The freshly broken product is glossy black or brown. The mining process consists, first, in stripping it, that is, in removing the shaly covering. This is done with dynamite and scrapers. Then the asphaltum is loosened with more blasting and carried direct to the steamer landing, whence it is shipped to San Francisco and adjacent cities to be converted into pavement. The annual output varies from thirty to sixty thousand tons.

View showing the working face of bituminous rock deposit, Santa Cruz, California.

The next section, San Luis Obispo County, contains an immense deposit of asphaltum estimated at eighty square miles of surface with varying depths, reaching a maximum of two hundred feet south of Arroyo Grande. While it is among the best appearing bituminous rock in California, the deposit has been very little developed. Twenty or more openings have been made, but most of them have been idle for a long time. One that has been actively worked, known as West Quarry, southwest of the city of San Luis Obispo, is located near the top of a mountain ridge, and like the Santa Cruz product, it is hard and is mined at the face of the cliff by blasting as before described. It is then reduced by cooking in huge double boiler arrangements, or else steamed until it attains a mealy consistency that can be spread for paving purposes.

Santa Barbara County contains numerous deposits, some of which have been uncovered while others have been untouched; probably many are undiscovered. One that was worked for a time and then abandoned, is a few miles from Casmalia and contains a very rich as well as uneven percentage of pure asphaltum, ranging from twenty-nine to sixty-eight per cent in the same deposit. Another is near Los Alamos, in the central part of the county, where there are three nearly parallel mountain ridges, the middle one of which is the location of what was about fifteen years ago one of the most extensive and interesting asphaltum mines, not only in California, but in the world. It was known as the Sisquoc mine, named from a creek near by. This, like the deposits already described, is near the top of the ridge, and the asphaltum is hard and was obtained by the usual stripping and blasting processes. The extent of the deposit has never been determined, but it is known to be a big one. A large amount of machinery was installed at great expense for developing this mine, for besides cable cars to carry the product the short distance to the refinery it was necessary to devise some

Photo. by D. B. W. Alexander.

View showing deposit of bituminous rock near San Luis Obispo, California.

View of complete working face of bituminous rock deposit, Santa Cruz, California.

means of preparing it to be transmitted to the nearest shipping point. The scheme evolved was to extract the pure asphaltum by distillation and then to mix it thoroughly with naphtha and pipe it by a gravity line to the nearest steamer landing thirty miles away. Here the naphtha was recovered and pumped back to the mine for use again. The enormous expense of installing and maintaining the plant proved prohibitive and the mine closed in a few years.

An interesting feature of these mines is the presence in the bituminous rock of large quantities of fossil shells, both gasteropods and bivalves.

Along the beach, both east and west of Santa Barbara, there are bold outcroppings of asphaltum, and of this region the United States Geologic Survey report of 1900-01 says: "It cannot but be regarded as pre-eminent in the oil-bearing nature of its rocks and the structure which has permitted its liberation." Of the two west of the city, one at More's Landing lies in a great cliff above the beach and has been worked but little, while another at La Patera, near by, was at one time an important mine. Several fissures here extending along the shore about an eighth of a mile are filled with asphaltum and have been opened to a depth of perhaps two or three hundred feet. This, too, is hard and brittle like the other deposits, and yet it has a tendency to ooze up from the floor of the shafts, especially below the hundred-foot level. It has been estimated that the amount of seepage collected in one of the shafts in a year's time was equivalent to a mass of asphaltum twenty feet in depth and of the length and width of the shaft. This tendency has made it impossible to penetrate to any depth in any of the veins because of the inevitable destruction of the timbering. This was among the earliest mines developed in the county and pick and shovel were the principal tools used.

About the same time that the mines of La Patera were developed, another deposit of a different character was opened up at Carpenteria, twelve miles east of Santa Barbara. This was a low bed of soft asphaltum several square acres in extent, alongside of the beach beneath a few feet of sandy soil. A huge pipe line was laid into the surf in order to strip the deposit by hydraulic means, a process that proved much more expensive than the other method. The asphaltum was then mined by means of hot shovels, the men working in an amphitheater of tiers of steps, cutting down each tier in succession and at the same time creating new ones. The shovels were heated by means of portable furnaces and cable cars carried the blocks of asphaltum to the refinery, close at hand, where the sand and volatiles were removed preparatory to shipping. After the various vats and stills had done their work, the rich black pitch was poured boiling hot from great swinging caldrons into barrels that carried it to all parts of the country. The mine was worked the most of the decade from 1890 to 1900, and then a large part of the machinery was transferred to the Sisquoc in the belief that the new venture would pay better. Ever since then the Carpenteria mine has lain idle.

A year ago, however, another extensive soft deposit half a mile distant, and uncharted by the Geological Survey, was prospected with the result that it has proved the most perfect road-making asphaltum yet uncovered. It was once an oil lake that became entirely absorbed by sand that drifted in in almost the precise percentage of coarse and fine material required. It runs something over twenty per cent pure asphaltum, so that approximately only ten per cent of mineral aggregate needs to be added for road making. The average daily output varies slightly with the temperature of the air, as a warm day very perceptibly softens the already soft deposit and the viscous mass can be cut much more easily. At Trinidad, on the other hand, the men are required to work at night while the material is brittle.

Besides natural asphaltum, California produces a large amount of the refined product. A large refinery for this purpose is located at Point Richmond on San Francisco Bay, and the oil is piped from Kern County, two hundred and fifty miles distant.

Three still more extensive plants are located in San Luis Obispo County, where local oil is utilized, and also oil from wells as far distant as one hundred and fifty miles. Heat is introduced through steam coils heated to from two to seven hundred degrees, depending upon the percentage of volatiles to be retained. In proportion as these are driven off the product loses its elasticity, hence the refined asphaltum is lacking in some of the qualities necessary to a good pavement. The life of the refined product is from five to seven years as against fifteen to twenty years for the natural product. A piece of natural asphalt pavement laid in Santa Barbara over twenty-five years ago, where traffic has been constant, is still in excellent condition, and it has received but little repairing during this period.

One reason that there is no greater activity in California asphaltum mines is the great cost of transportation, with the result that Trinidad continues to compete successfully with us in the eastern markets. Her importation to the United States in 1911 was nearly 112,000 tons, and of our total domestic production the same year, 350,000 tons, California contributed a good margin over half. The principal reasons, however, that so little mining is being done in these fields is the expense connected with it, and the very limited demand for the asphaltum. When roadmakers become more familiar with the durability of natural asphalt pavements and when the good roads movement gains greater momentum, it may be expected that California deposits will enter upon a new era of development.

Automatic Wireless Train Control

By F. C. Coleman

CONSIDERABLE interest is being taken in an installation of wireless automatic train control which has been laid down on the Hampton Court branch of the London and South Western Railway Company. This system is somewhat similar to that which has been working for some time on four sections of the down line and four sections of the up line of the Canadian Pacific Railway, near Toronto.

Under this automatic system of wireless train control invented and patented by Mr. Frank W. Prentice, a current of high frequency is sent along the line by means of a wire laid in the four-foot troughing on the sleepers. This wire is known as the wave wire, and it acts on an arrangement of antennæ—technically known as the harp—which is on the locomotive, and is composed of nine wires. So long as the harp is receiving energy from the wave wire, a green visual signal is given in the cab of the locomotive. The high frequency current enters an apparatus box at the end of the section, and its primary is controlled by a relay connected to an ordinary track circuit. This relay, in accordance with the principles of track circuiting, now so well known, is de-energized when a train or part of a train is in the section, and this causes the flow of the high frequency current to cease. The harp now no longer receives its energy, so that a relay on the locomotive is closed, and this causes the green visual signal to be switched out and a red light switched in. The brake is automatically applied simultaneously, and a whistle or buzzer may also be sounded.

The apparatus box consists of a transformer for the track circuits and one for the high frequency current, a spark gap, condenser and helix, also the relay, already referred to, connected with the track circuit. On the locomotive, besides the harp, there is a coherer which is continuously rocked—about eighty times per minute—by a solenoid and co-operating latch device. Working in synchronism with the coherer is a relay controlled by a time relay, which in turn controls a master relay. The time relay is provided to allow for decoherence. The last-named controls in its turn the solenoids used for operating the whistle and brake valves and the red light. A push button is provided to allow the driver to release the brake should the train be pulled up at an unsuitable place, but this does not switch out the red light.

The diagram of connections illustrated herewith sets forth in greater detail the main features of the system which has been outlined above. Fig. 1 covers the apparatus on the engine, while Fig. 2 includes the co-operating arrangement on the track. The latter may receive first attention. The track circuit is fed from any suitable source of supply 9—in this case 110-volt 60-cycle alternating current—through the transformer 6. The secondary is connected to the running rails, which are divided into the signaling sections, as usual, by insulated joints at 7. The track circuit of one section passes through the relay 5 of the section behind, so that the presence of a train or vehicle causes short circuiting, thereby releasing the relay 5 for the section in which the "danger" intimation is to be given. The high frequency plant, the primary of which is controlled by the relay 5, includes the transformer 1, spark gap 2, condenser 3, and helix 4, and is of any suitable character as long as it supplies the required high frequency current to the wave wire 8. It will, therefore, be seen that the wave wire 8 continues to receive high frequency current unless the de-energizing of the governing track circuit relay by short-circuiting causes its cessation.

On the engine, the harp 1, Fig. 1, transmits radiant energy received from the wave wire to the coherer 2. This is, as has been explained, continuously rocked by means of solenoid 3 and its co-operating latch device. Relay 4 operated in synchronism with the coherer 2, being closed as the waves from the harp break down the resistance of the coherer and reopened as the resistance is re-establishd. Its closing completes the circuit of relay 5, but as the latter is of a slowly de-energizing time design, it holds over the pulsating action of the relay 4, causing continuous action of the master relay 6 as long as the influence of the high frequency waves from the wave wire are felt. The master relay 6 controls solenoids 7 and 8, respectively, which are used for operating the whistle and brake valves, and also the display of the red or green light. The latter is continuously presented, while the high frequency waves are being received, but immediately the influence is lost, the green changes to red, the brakes are applied, and a whistle or buzzer is caused to sound. The holding relay 9 for the brake system is fitted with a push button 10, whereby the driver can release the brakes to control the running of the train at discretion through the remainder of the section; but the red indication continues to be displayed, and the whistle or buzzer to sound so that the driver cannot possibly ignore the warning he has received.

If the section ahead becomes clear, whether the train is standing or is still moving, the corresponding track circuit relay is again actuated, re-establishing the high frequency circuit, and thereby restoring the indicator, brake and whistle or buzzer relays to "line clear" conditions. It is pointed out, therefore, that (1) the driver receives a persistent "danger" indication, in combination with initial brake application; (2) subsequent action at discretion is only permitted in conjunction with insistent warning; (3) he is informed of the restoration of "line clear" conditions; (4) the apparatus involves the positive maintenance of a "line clear" indication, in combination with positive action in the event of "danger," failure or other adverse conditions. The automatic character of the installation is also emphasized by the inventor, who urges that it enables a line to be worked to its full traffic capacity, there being no loss of time during the transmission of bell signals and the mechanical operation of a number of levers. It is claimed, also, that in case of fog a driver is given all necessary information as to the conditions ahead, even if he cannot see any of the fixed signals; that in circumstances where it is difficult to give a good look ahead, owing to the layout of the line, the same advantages are realized; and that the installation meets all requirements as regards safeguards against the non-observance of signals, combining, in fact, the development of the track circuit, now so strongly recommended in many quarters, with the direct signaling and control of trains. It has been shown in regular working that the effect of another engine on the section was sufficient to pull up a train against full steam and with the regulator still open.

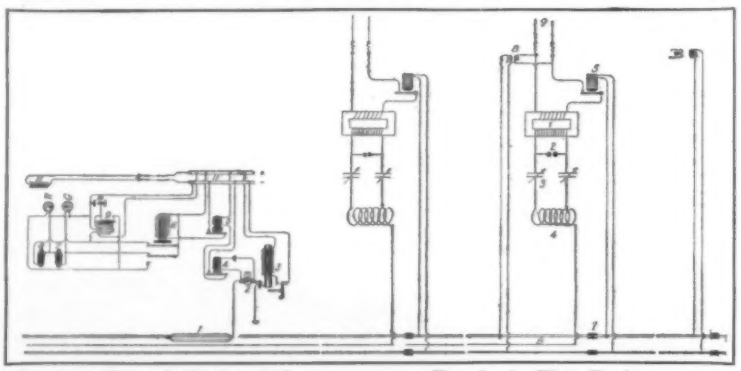


Fig. 1.—1, Harp; 2, Coherer; 3, Coherer Operating Solenoid and Mechanism; 4, Detector Relay; 5, Time Element Relay; 6, Master Relay; 7, Whistle or Buzzer Solenoid; 8, Brake Valve Solenoid; 9, Hold Relay; 10, Push Button; 11, Bus Bars; 12, Storage Battery; *R*, Red Light; *G*, Green Light.

Fig. 2.—1, High Tension Transformer; 2, Spark Gap; 3, Condenser; 4, Helix; 5, Track Relay; 6, Track Transformer; 7, Insulated Rail Joints; 8, Wave Wire; 9, One Hundred and Ten Volt, Sixty Cycle Feed Wires.

Diagram of connections of the automatic wireless train control system.

Hamburg University Extended for Science

THE new university at Hamburg is an extension of the important colonial institution known as Kolonialinstitut which was founded in that city at a previous date. The university is to have chairs of philosophy, law and colonial sciences, and the annual budget will be 2,500,000 marks. Upward of 15,000,000 marks will be expended for the construction of the various buildings, comprising the different institutes annexed to the university. One of the interesting features is the university extension scheme which provides public and free evening courses.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

To Strike the Pentagram

To the Editor of the SCIENTIFIC AMERICAN:

The method of striking the pentagram or pentacle, proposed by Mr. John P. Robinson in your issue of November 22nd, is ingenious, but less accurate than the old-fashioned way of dividing the circle. This will appear to anyone who will carefully measure the drawing shown, or will attempt to construct the figure from the directions given.

In your drawing the lines 1—2, 1—5 and 2—6 are of equal length, but the lines 4—5 and 4—6 are longer than the others (and of course the spacing of the points is unequal), and this will be the invariable result of following Mr. Robinson's plan. This would not be a very serious matter in laying out stars for lawn decoration and similar purposes, but unless the primary lines are exactly perpendicular to each other, the irregularities above mentioned will be increased. Moreover, there are better ways.

The draughtsman has his own system of producing the pentacle, but for the man whose needs are less exact, the following plan will yield a very close approximation. Strike a circle whose diameter is eighty, or some multiple or divisor of it. If the dividers are now set to forty-seven eightieths of the diameter they will almost exactly divide the circumference into five parts, and the points, when properly connected, will form the star.

This is sufficiently accurate for any ordinary work, and may easily be performed in the following manner: To divide a circle of, say, 20 feet in diameter, take a light strip of wood 12 feet long, and having fixed a center-pin at one end, drive a long nail 10 feet from it, and with this strike the circumference. Now one eightieth of 20 feet is one quarter of one foot, or 3 inches, and forty-seven eightieths are, of course, 11 feet and 9 inches. Remove the nail, therefore, and drive it that distance from the center-pin, and placing the latter at some point on the circle, scratch across it with the nail. Place the pin at this point and repeat the operation, and so on. If carefully done, it will be found that the variation is a negligible quantity. Small pins may be driven in the proper places, and a chalk-line stretched from one to another will produce the figure desired, without resorting to the "cut-and-try" method formerly in vogue.

Suppose, as another example, a farmer wishes to cut a star-shaped ventilator in the gable of his barn. Let him strike a circle of (say) 10 inches in diameter. Ten inches contain eighty eighths, and by setting his compasses to forty-seven eighths (5⅞ inches) he can readily divide the circle into five equal parts.

In using this method it is better, when practicable, to take one of the ordinary divisions of the carpenters' rule (sixteenths, eighths, quarters, halves, or inches) as the unit of measurement, and eighty times this unit for the diameter of the circle, as it facilitates finding the fraction (forty-seven eightieths) necessary. This plan has no advantage over the older one of pricking off the circle, except that it is more expeditious. It is only necessary to remember that *forty-seven eightieths* of the diameter of any circle is almost exactly seventy-two degrees of that circle, and this fraction will serve for laying off pentagons or pentacles whenever *absolute accuracy* is not required. DAVY JONES.

New Brighton, Pa.

A Suggestion for Government Automobile Road

To the Editor of the SCIENTIFIC AMERICAN:

As the question of Government road building is likely to be discussed in Congress this winter it might be a good idea for opinions to be given as to what kind of roads the Government should build or assist to build.

I think the Government's chief interest in road building is in the more important roads which should run from the principal seaport cities to the principal interior cities. The first road to be built should start from New York and should be surveyed near the Hudson River, the Erie Canal, the Lake Erie shore, then on to Chicago, and from there on to New Orleans *via* St. Louis. Such a road should have no grade crossings and should have a surface width of not less than 100 feet, the central portion should have a finished surface at least 25 feet wide built as well as the best city street, the remaining width on each side should be dragged and kept as smooth as possible and treated with oil or other preparations which experience might prove to be best for improving earth roads. The object in having wide roads would be to give plenty of room to avoid accidents. As a further precaution there should be no loading or unloading of freight or passengers on the right of way. This should be done on the outside on ground provided by the cities for this purpose.

Also the wide road would encourage the building of wider automobiles with more wheels under them which would increase their carrying capacity.

The method of building such roads would be for the Government to let the contracts for the grading; culvert building, fencing, and finishing the road, to corporations. After the completion and acceptance of the work the Government should charge a toll to users of the road sufficient to pay for maintenance and a low rate of interest on the investment. In this way the Government would borrow the money to build the road and then collect the interest and cost of maintenance from the traffic, which is precisely the way it proposes to do with the Panama Canal, a method which is fair beyond all question.

This system of Government roads might be regarded as complete when a sufficient number of roads were built to take care of the interstate commerce. It might be proper for the Government to contribute a small sum per mile for dragging the roads on the rural routes, but further than this I can see no justification for Government aid.

I wrote a letter to the SCIENTIFIC AMERICAN which was published in the November 30th, 1912, issue on the subject of "Automobile Toll Roads" such roads to be built and owned by corporations, allowing automobiles to use the road by paying tolls. Such roads would be excellent feeders for the Government toll roads, or the States could build their own automobile toll roads just the same as the United States Government could, as explained above. A system of Government toll roads such as I have suggested I think should be used exclusively for automobiles, because the Government would be more particularly interested in interstate commerce and interstate commerce is only possible on public roads when the automobile is used. Such a system of Government roads would also be valuable for rapid maneuvering of troops in case of war.

Stanberry, Miss. CLIFTON R. SUMMERS.

Automatic Pilot for Signal Observation

To the Editor of the SCIENTIFIC AMERICAN:

Much is written these days about railway accidents—their prevalence and their prevention. Recommendations of various character have been made and experiments have been carried out, yet the appalling death rate is not materially decreasing.

According to some writers, the ideal prevention of accident would be to take the final control out of human hands and to make same entirely mechanical. But the automatic stop will never reach such perfection that it cannot be tampered with, or that it can become absolutely dependable in all emergencies. What manner of automatic stop could have prevented the collision with the huge boulder on the track of the Chicago, Burlington and Quincy near Genoa, Wis., on the morning of November 3rd, when the train was wrecked and six men were severely injured?

The remedy lies not in perfecting automatic control, but in making the human factor more efficient. In line with this thought I would make the following suggestion:

On top of every railway locomotive, immediately behind the headlight, there should be constructed a small windowed cabin or observation room, containing a convenient seat for one person, whom we may call the pilot. Upon approaching or passing a signal the pilot would be required to touch a button or series of buttons which would register the fact that the signal had been observed. The engineer would have a similar set of buttons to register the same signals. As the two observers could not communicate with each other to compare notes, there would be no dependence upon one another, and the reading of the recording instruments by proper officials would be a check on the watchfulness of both the pilot and the engineer. Further than thus recording signals, the engineer's duties would be in no manner changed from the present duties of an engineer. The pilot's cabin should also contain levers for emergency control, so that should the engineer fail to observe a signal or to notice an obstruction, the pilot would be able to bring the train to a stop.

An accident through negligence in observing signals would become practically impossible, as there would be two observers instead of one, and both would be more careful than the engineer of the present, because the observations of one would be a check on the observations of the other, and neither would dare to let a signal pass unnoticed, through fear of the penalty.

The expense of maintaining such a system may seem excessive, but this cost would probably be offset by the saving in rolling stock and lawsuits, and the safety of the public demands that the railroads work for safety even though it should make extra expense.

The objection may be raised that the pilot's position so near the front end of the locomotive would be very perilous in case of accident, and that no one would want the job. Under the new conditions thus created the pilot's position would be safer than the engineer's is at present; and, furthermore, a study of the matter may point out some better plan for attaining greater safety in this respect. E. A. A.

Joliet, Ill.

Weather Prophets

To the Editor of the SCIENTIFIC AMERICAN:

For many years I have been almost a constant reader of your valuable journal, and its timely articles are very much esteemed by a host of others besides myself.

As I am after sowing, planting and reaping, your article on weather forecasting, under date of November 1st, 1913, naturally struck my eye.

What I did hope to find was a reliable forecast for say the next six months; but you only hint at the schemes of the charlatan, the delusion of the crank and refer vaguely to some method in the madness of the honest ignoramus which enables him to find a lucrative market for his prognostications, etc.

Whether you had in mind the Hackensack weather prophet does not appear; but I saw it stated some years ago, on good authority, that Mr. DeVoe did not only sell his predictions to the farmers of the United States, especially those located in the West, but that he also supplied residents of foreign countries with his prognostications, presumably for a good price, if memory serves me right.

The old saw, "Give the Devil his due," may be appropriate, and as an honest, hard-working, natural-born citizen of the United States, I heartily indorse holding up to the limelight the mischievous doings of frauds, charlatans, ignoramuses, or cranks.

Had you more definitely pointed out the activities of such persons, by in some manner illustrating or demonstrating the schemes of frauds and charlatans, you would have done the general public—your patrons—a service, a favor; else how shall they be forewarned against parting with their money for what is worse than trash—absolutely useless?

I, for one, should like to be thus posted and would appreciate very much another article on the same subject warning me in no uncertain way as to the schemes of frauds and unreliable persons who would fool the public, and especially the farmers. E. KOBER.

Asheville, N. C.

What Dr. Lardner Said About Steamships

To the Editor of the SCIENTIFIC AMERICAN:

In your editorial of November 15th, "The Future of the Dirigible," you speak of the commonly accepted story that Dr. Dionysius Lardner proved mathematically in a paper before the British Association that it would be impossible for a steamship to carry enough coal to propel her across the Atlantic Ocean.

As at that time steamships had already crossed the ocean, I was interested and looked the matter up, and had the good fortune to find Dr. Lardner's original paper. It proved, as I anticipated, that he never made the statements popularly attributed to him. What he really said was that in the state of steam engineering at that time it would not be commercially profitable to run a line of freight steamers between Liverpool and New York, which was perfectly true. He not only recognized the possibility of such a line, but suggested their use in the carriage of passengers and express matter.

Since his day the invention of the surface condenser, the compound engine, the high pressure marine boiler, and many other improvements, have revolutionized commerce and driven sailing vessels from many trade routes, except for the carriage of very heavy and bulky freight, like coal, lumber, etc. It is only fair to Dr. Lardner's well deserved reputation that this error should be corrected, especially as the story is often used in connection with the exploitation of Keely motors and other scientific swindles, as an illustration of the unreliability of scientific investigators, and the worthlessness of scientific research. A. P. N.

Haverhill, Mass.

International Safety-at-Sea Conference.—The International Conference on Safety at Sea, which was formally opened on November 12th, is now in session at the British Foreign Office, London. In a message of welcome King George, who once commanded a British cruiser, says in part: "The question the delegates are about to consider is one in which I take a special interest, for it affects closely the lives and welfare of a vast number of my subjects; and as a sailor I have had personal experience in many of the matters which will come up for consideration by the Conference." The gathering is presided over by Lord Mersey who, it will be remembered, was the president of the British commission which investigated the "Titanic" disaster. The twelve nations represented are the United States, Great Britain, Belgium, France, the Netherlands, Russia, Denmark, Germany, Norway, Spain, Canada and New Zealand.

Fig. 1.—Pithecanthropus.

Fig. 2.—The Spy skull No. 1.

Fig. 3.—The Spy skull No. 2.

Three skull caps from the Neanderthal race.

The Origin and Evolution of Man

Recent Views Suggested by the Discovery of the Piltdown Skull

By Dr. J. Leon Williams, Fellow of the Anthropological Institute of Great Britain and Ireland

IF very widespread publicity on the part of the press is a fairly accurate measure of general interest in a subject, then the prominence and space accorded to recent interviews with me on the theme of prehistoric man indicate something more than mere curiosity on the part of the public. It has also been very interesting to me to observe that nearly all of the papers in different parts of the country that have mentioned the subject have given special prominence to the statement of the great age of man on the earth. That is really one of the vital aspects of the whole problem of man's origin. Recent discoveries have made it quite plain that the human race has been in existence for a much longer time than has generally been supposed by the majority of scientific men. The only alternative view that can now be taken is that evolution has not proceeded altogether along the lines of the Darwinian hypothesis.

I propose, therefore, in response to the request of the Editors of the SCIENTIFIC AMERICAN, to deal with certain phases of the subject which bear directly on this great problem. The main features of the Darwinian theory of evolution are too well known to the readers of this paper to require elaboration. They can be largely summed up in the two terms—*variation* and *natural selection*. The causes of variation are still obscure; but the working of natural selection is patent enough to any observant and thinking person. The nature of the environment exercises a profound modifying effect on species, and it is highly probable that this factor in evolution played a much more important part in the past than in the present. But all of these factors of the Darwinian theory work in a very slow way. Dr. Alfred Russel Wallace told me, in an interview I had with him last July, that he did not believe a single new species had come into existence during the whole Pleistocene era, and this, according to Penck, the great German geologist, covers a minimum period of 500,000 years and may possibly extend to 1,500,000.

Accepting even the lowest estimate, one of two things is evident: either the conditions for the production of new species are much more unfavorable in recent than in early geological times, or Darwin was right in his earlier views that enormous periods of time were required for the production of species. But there is now in the field another school of evolutionists, led by the eminent botanist, Hugo de Vries, who believe that species may appear quite suddenly. This has certainly been fully demonstrated in the vegetable kingdom, but Wallace regarded these as freak or, at least, exceptional productions, which in no way militated against the fundamental principles of Darwin's teachings.

I will try to present, very briefly, some of the evidence now in our possession bearing on these two theories as applied to the origin and evolution of man. Prof. Arthur Keith, Hunterian Lecturer on Anatomy at the Royal College of Surgeons in London and author of "Ancient Types of Man," says, in describing a prehistoric skull found thirty feet below the surface when the great Tilbury docks were excavated in 1883, and estimated to be between fifteen and thirty thousand years old, "In Owen's time those scientists who had come, under Darwin's influence, to believe in the evolution of man, expected to find in an individual so ancient as the Tilbury man some distinct trace of his simian origin." But this skull was purely modern in type with no ape-like characters in evidence. Five years later, across the river from Tilbury, the now celebrated Galley Hill skull was unearthed in a high terrace of the ancient Thames. Prof. Keith asks for about 200,000 years as the age of this skull. Here again we have a specimen which although a little more primitive in some of its characters than the Tilbury "find," is still essentially modern.

If, therefore, we find the modern type of man in existence 200,000 years ago, it becomes perfectly evident that we shall have to get very far back in the past to find that human relative of the anthropoids from which we have undoubtedly descended.

Let us for the moment leave these ancient records of *modern* man and turn our attention to another and distinct group of discoveries.

In 1891 Dr. Eugene Dubois, Professor of Geology in the University of Amsterdam, found on the banks of the Bengawan, at Trinil, Java, the top of the skull, two molar teeth and the thigh bone of a creature presenting characteristics which placed him in a position about midway between the highest apes and the lowest human beings heretofore known. The estimated size of the brain was 900 cubic centimeters, that of the largest gorilla being 600 cubic centimeters, while the lowest Australian savages have a skull capacity of about 1,200 cubic centimeters. These facts and others of like nature led Dr. Dubois to give the name of *Pithecanthropus erectus*, or ape-man, to his Java discovery. There is still a difference of opinion as to whether these fossil remains should be ascribed to the late Pliocene or the early Pleistocene era; but on any reckoning they are probably the oldest and most primitive human relics discovered up to date. On the basis of Penck's measurement of geological time they are more than 500,000 years old.

Fig. 4.—Dr. Woodward's restoration of the Piltdown skull.

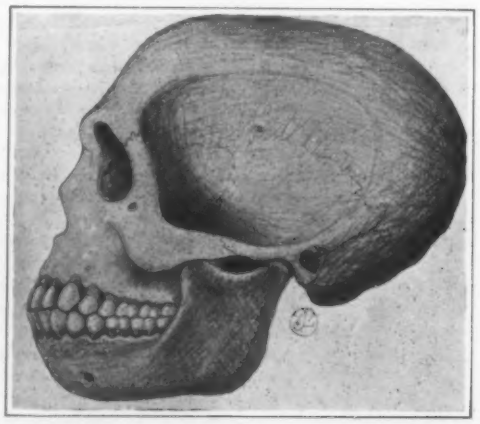


Fig. 5.—Restoration of the Piltdown skull according to Dr. Williams.

Observe the differences in the teeth.

In a rocky ravine, known as the Neanderthal, near Elberfeld, Germany, a few miles from the Rhine, there was found in 1887, in a cave, the upper part of a skull about which a fierce scientific controversy raged for many years. Virchow, the great German anatomist and anthropologist, maintained that this could not be the skull of a normal human being. But the subsequent discovery of more than twenty skulls of the same general type proved that Virchow was quite wrong. The discovery of so many skulls of one ancient type, extending, as they do, over a great stretch of time, is one of the most important features of our knowledge of primitive man. Let us compare three or four of these specimens.

We may take that wonderful skull known as "The Man of La Chapelle-aux-Saints" as typical of the race. We see at a glance that we have here to deal with something altogether different from the modern type of man. Although the head is of great size with a larger brain capacity than the average modern man, the skull has very marked anthropoid features. The forehead is very low and retreating; the brow ridges above the eyes are very heavy and projecting; the eye sockets are enormous in size; the nasal opening indicates a very large, broad, flat nose; the jaws are prognathous with a markedly retreating chin.

Belonging to the same race as the man of La Chapelle-aux-Saints are the skulls found at Spy, Belgium.

If, now, we take the skull cap of the Java ape-man and place it beside those of Neanderthal and Spy, we see that the chief characteristics are the same in all of them, but that there has been a gradual increase in size, an evolution from the earliest Neanderthal man to the later man of La Chapelle. That they all belong to the same race is evident when we look at Prof. Boulè's tracings in which they are all compared, but we see that there has been great brain development from the Neanderthal man, shown by the inner dotted line, to the heavy, black line which represents the La Chapelle man. The difference would be even more strikingly shown in a plan view of the skulls.

Now, I do not think there can be any doubt but that the Java ape-man is in the direct ancestral line of the Neanderthal man. The main features of the skulls are precisely the same. If this is so, then between the brain of the Java ape-man and the La Chapelle man we have a progressive range of capacity of from 900 to 1,650 cubic centimeters, representing an advance which probably extends over 300,000 years. This I regard as the most important evidence we possess of the essential truth of the Darwinian theory as applied to the evolution of man. But we may also approach our problem from another and totally different point of view.

It is well known to all scientific men who have given much attention to this subject, that the lower jaw is the most important single bone in the human skeleton, as indicating man's place in the evolutionary scale. If, for illustration, we take Prof. Keith's drawing of the Heidelberg mandible, one of the most ancient and remarkable human jaws ever discovered, represented by the black outline in the drawing, and place a modern European jaw over it, shown in the drawing in flat shade, we see the meaning and significance of human evolution in this particular feature at a glance.

If we next compare the Heidelberg jaw with that of the gorilla as shown in Fig. 9, we see what its rela-

tionships are, both with reference to modern man and the apes.

We observe that the Heidelberg jaw is, in some respects, heavier and stronger than that of the gorilla. The ramus, the ascending part, is wider and the depth of the jaw, from the teeth to the lower border, is greater than in the gorilla. *But the teeth are purely human* and not quite as large as they are in some of the primitive races of to-day. The front of the jaw, instead of projecting to form a chin as in modern man, slopes backward as in the ape, and the inside of the front part of the jaw, that part which lies immediately beneath the tip of the tongue, is devoid of those little prominences to which some of the more important muscles of the tongue are attached. In their place we find a depression, as in the ape. This leads to the conclusion that speech was absent or but poorly developed in the Heidelberg man. We thus have in this jaw certain contradictory features. We have the teeth of modern man united to the jaw of the anthropoid ape. This tells us that evolution has not proceeded by a gradual, harmonious and evenly balanced modification of all the parts of an organism.

Man threw off some of his anthropoid features much more rapidly than others. It also tells us that the purely human arrangement and form of the teeth were fully evolved at the very beginning of the Pleistocene era. Here again we see that if Penck is right in his estimates of time, we must go back more than 1,000,000 years to find the purely anthropoid ancestor of man, if evolution has taken place according to the Darwinian theory.

We come now to the consideration of a prehistoric skull which is probably destined to be the object of more scientific discussion than any previous discovery in this field. I refer to the so-called Piltdown skull found by Charles Dawson, F.S.A., F.G.S., and Dr. A. Smith Woodward, F.R.S., at Piltdown, Sussex, England.

This discovery, the first published report of which appears in the *Journal* of the Geological Society of London for March, 1913, consists of the larger part of the skull bones and the right half of the lower jaw.

The "find" was made in a flint-bearing gravel which has yielded some of the most ancient forms of stone implements and the teeth of sub-tropical species of animals, including those of the hippopotamus, an early Pliocene elephant, the mastodon and others. There can be no doubt that these remains represent a being who lived during late Pliocene or early Pleistocene times. The lower jaw is more primitive in some features than the Heidelberg mandible. The peculiar features and relationship of these two astonishing human relics are shown in Fig. 8, taken from the *Journal* of the Geological Society above mentioned. The ascending ramus of the Piltdown jaw is somewhat smaller than this feature in the Heidelberg jaw, but the slope of the front part is much greater and in this respect more ape-like.

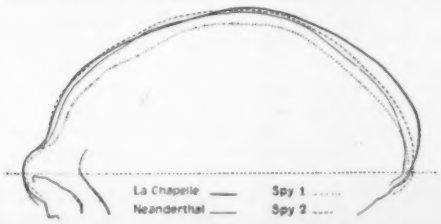


Fig. 10.—Outline tracings of various human skulls of the Paleolithic Age. (From Boule.)

Fig. 11.—The Galley Hill man. Modern in type, but estimated to be 200,000 years old.

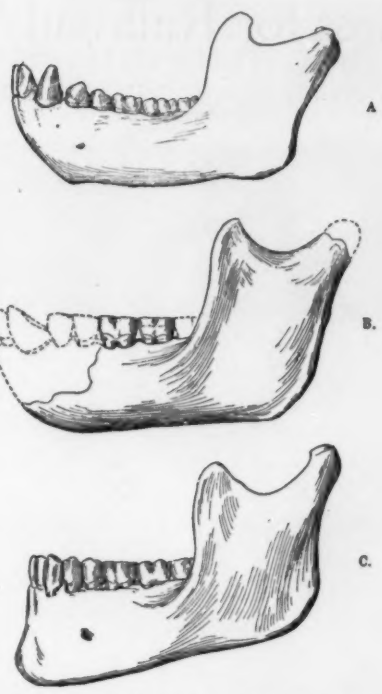


Fig. 6.—Restoration of the Piltdown mandible (B), compared with that of man (C) and the young chimpanzee (A), in left side of view.

But for the two molar teeth found in the jaw it would undoubtedly pass as the remains of a primitive anthropoid creature. But the teeth, although presenting individual peculiarities which distinguish them from those in the Heidelberg jaw, are purely human and the variations are not greater than are found in human teeth of to-day. In Dr. Woodward's restoration of the Piltdown skull he has given a distinctly anthropoid character to the front teeth. In my own restoration of this mandible, which was presented before the International Medical Congress, held in London last August, I have represented the front teeth as of a coarse human type. I will quote my reason for this from the remarks I made before the Congress:

"Let us consider a little the probabilities and the few facts we have concerning this dentition. It resembles the Heidelberg mandible more than any other human jaw yet discovered, but although exhibiting much more refinement in structure than the Heidelberg jaw, it is more primitive in certain respects than that specimen. The backward slope of the front of the jaw is evidently greater than in the Heidelberg mandible and the simian character of the lingual part of the front of the jaw is even more marked. But is the variation in these two jaws greater or as great as we sometimes find in modern jaws? I do not think so, and while it may be legitimately attributed to a somewhat earlier date than that of the Heidelberg specimen, I suppose no one would suggest that it should be placed farther back than late Pliocene times. The critical question that we have to ask, then, is this: 'Is there any reasonable probability that the human ancestor of late Pliocene times would have so anthropoid a jaw as is shown in this restoration by Dr. Woodward?' The teeth in the Heidelberg jaw are essentially modern in every respect and smaller, notwithstanding the enormous size of the jaw, than the teeth of some primitive races of to-day. On what grounds may we assume that a little farther back we should find so simian a dentition as we have here? This form in Dr. Woodward's restoration is separated from the Heidelberg mandible by untold ages. If the Heidelberg jaw is late Pliocene, the Piltdown mandible would have to be Miocene, and I confess that I do not know that we should be warranted in assuming that the human ancestor of Miocene times had a jaw so much like that of the modern ape. It is, I believe, assumed that the common ancestor of man and the anthropoid apes had a generalized form of dentition which probably resembled the present human form as much as the present anthropoid form. We have some indications of that generalized form in Dryopithecus, Pliopithecus, and Mesopithecus. Starting from that generalized form the human and the simian forms have each grown more and more specialized in accordance with the original variation. If the separation of the two branches occurred in Miocene times and the specialization in different directions continued until the late Pliocene period, is there any probability that we should find this anthropoid dentition after that immensely long period of progression toward the modern human?

"We have, I think, a logical right to assume, in the absence of any evidence to the contrary, that the dentition of early or late Pliocene man resembled the human dentition of to-day as closely as the dentition of the early or late Pliocene ape resembles that of the ape of to-day. If I am right in that assumption then it is clear that the dentition of the restored Piltdown skull is unwarranted."

Since the date of that meeting Dr. Woodward has found a fossil canine tooth in the gravel beds near the spot where the other portions of the skull were discovered. He claims that this tooth, which is distinctly anthropoid in character, belongs to the Piltdown jaw, and that it, therefore, establishes the correctness of his restoration. Now all the other bones of this skull are of a rich brown color caused by the iron in the gravel beds, but this new discovery is of a dead black color, totally different from all the others. If this tooth was originally in the Piltdown mandible, as Dr. Woodward claims, I can think of no reason for such a strange phenomenon as the marked difference in coloration, and, so far as I am aware, there is no known precedent for it. My own criticism of Dr. Woodward's restoration of the Piltdown skull was confined to the dentition, but Prof. Keith has made a very vigorous and trenchant assault on the entire restoration.

Dr. Woodward gives the skull capacity of the Piltdown man as 1,070 cubic centimeters. Prof. Keith estimates it at 1,500 cubic centimeters, or a little more, thus bringing it about up to the average of modern man. The point is of vital importance in its bearing on the problem of human evolution. It seems evident at a glance that the Piltdown skull is not in the line of descent of the Neanderthal race. The supra-orbital ridges are but slightly developed and the forehead is fairly full and well developed. The upper part of the head is therefore, according to Prof. Keith, in the line of descent of modern man. This brings us face to face with an astounding situation. We have in the Piltdown skull the remains of a being estimated to be half a million years old, with the skull and upper part of the head closely resembling modern man, but with the lower jaw of a gorilla. We cannot escape from the fact that

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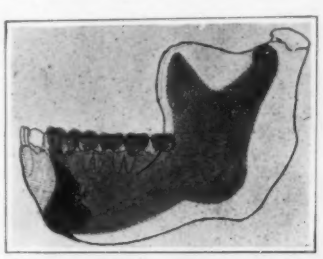


Fig. 7.—Profile drawing of the Heidelberg mandible (in outline) contrasted with the lower jaw of a modern European (shaded).

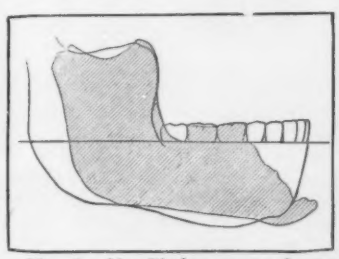


Fig. 8.—Mandibular ramus from Piltdown superposed on that of Homo heidelbergensis, showing greater chin projection.

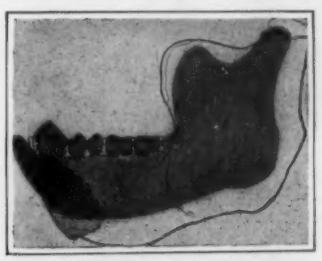


Fig. 9.—Profile of the Heidelberg mandible (outline) contrasted with that of the mandible of a chimpanzee (shaded).

Fig. 12.—The man of La Chapelle-aux-Saints. A representative of the Neanderthal race.

Wireless for Railroad Trains

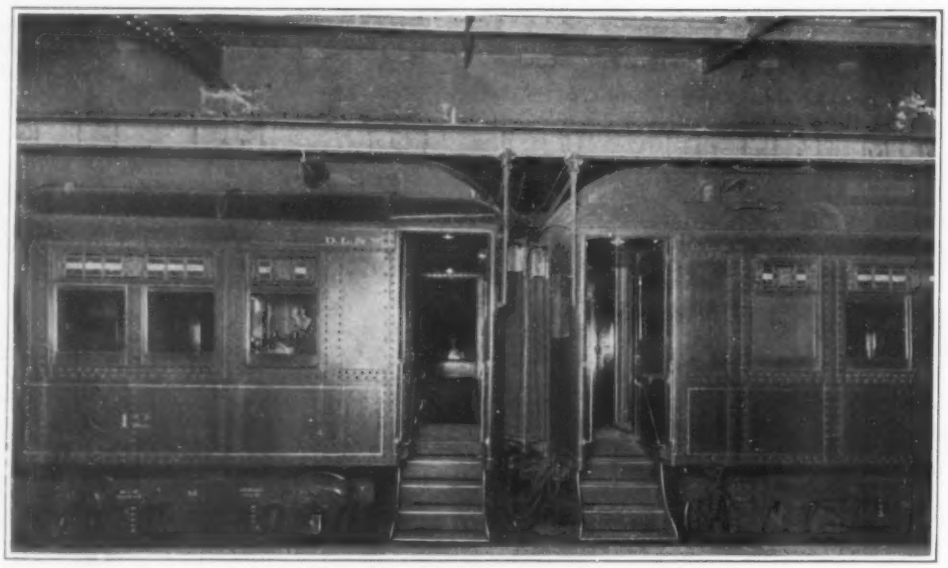
A New System Which Secures Uninterrupted Communication at All Times

THE utility of the wireless telegraph in directing the movements of ships at sea, in communication to and from ships, and in calling for help in emergencies has been strikingly demonstrated, but it remained for an enterprising American railroad to apply wireless communication to and from moving trains. A test just made successfully on the Lackawanna Railroad on a regular express train running between New York city and Buffalo, though only a partial test in the experiments thus far conducted, has shown immense possibilities of safety and time saving by insuring that trains will always be in communication at any speed and at any distance from stations, regardless of "line breaks" from winter blizzards or from washouts, fog which obscures signals, and other extraordinary conditions.

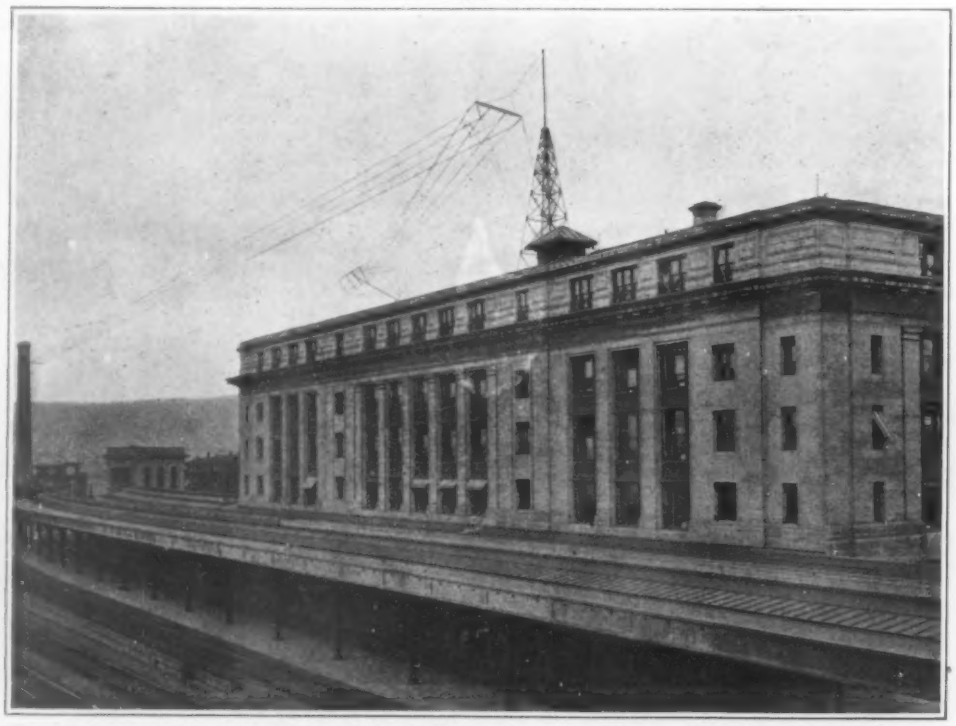
In the ordinary wireless telegraph system messages are sent and received between stations equipped with antennæ or "aerials" supported on high towers. The Lackawanna Railroad has stations of this kind at Scranton, Pa., and Binghampton, N. Y., with a working radius of about 300 miles. But, of course, it is out of the question to place any structure such as an ordinary aerial on a railroad train which has to pass through tunnels and under bridges, and a prominent feature of these tests is the use of a highly special aerial for the train installation. Some very recent experiments, notably those conducted on November 21st and 23rd, have demonstrated that wireless communication can be maintained to and from a train equipped with a very low aerial, viz., a quadrangle of wire supported at a height of only eighteen inches above the roof of the car. The distance between Scranton and Binghampton is about 65 miles, and in the experiments just made it was found possible to maintain communication from a train running at 55 miles per hour, part of the time direct from the train to the fixed station away from which the train was speeding; and when the train had proceeded to a point too far away for its short aerial to force signals through to this first station direct, the signals were delivered to the station by being picked up at the second station and relayed back. At no time during the tests was the train out of communication with both stations in this way.

The arrangement used consists of four quadrangular aerials mounted on the roofs of four adjoining cars of the train, and only 18 inches above same, as stated. Each quadrangle is connected to its neighbors on the other cars by a special attaching plug. The wireless operator's station is installed in a booth in the third car of the group, so as to bring the lead from his apparatus to the four-fold aerial at a point at the middle of same. The regular Marconi system is employed, except that the power is furnished by a special motor-generator set driven from the regular train-lighting dynamo, and the ground connection is made to the rails by a wire to one of the car trucks. The aerial is of heavy copper wire, and is insulated for the high sending voltage (between 8,000 and 9,000 volts) by large porcelain insulators mounted on iron posts at the corners of the car.

The wireless telegraph installation.



Two of the cars of the wireless telegraph equipped train, showing the aerial above the car roofs and the wireless operator's cabin.



The 700-foot aerial of 300 miles working radius on the roof of the Lackawanna Railroad station at Scranton.

The special usefulness of the system was indicated the other day when the conductor of the train was taken ill, while his train was running at high speed, westbound. The next station at which a relief conductor could be obtained was Scranton, 30 miles away. Ordinarily a delay would have been unavoidable—either a stop in order to send a telegram by wire asking for a relief conductor or a wait at Scranton after arrival at that point. But thanks to the wireless telegraph equipment there was no need to take either of these measures. Instead, the conductor notified the wireless operator on the train and the latter sent a message direct to Scranton, with the result that a relief conductor was on hand to take charge when the train pulled in. In the same way an extra car, needed to provide accommodations for an unusual crowd of passengers, was ordered to be in readiness to be coupled on at Scranton, thus eliminating the delay that would ordinarily have been experienced in getting the car up from the yard.

Apart from this emergency value, however, a demonstration that the wireless telegraph can be depended upon for unfailing communication between running trains and fixed stations and between the trains themselves may mean a revolution in the operation of trains comparable to that which followed the introduction of the ordinary wire telegraph for this purpose. When railroads can install reliably tuned equipment whereby dispatchers and train conductors are able to keep in direct touch regardless of stops, it becomes possible to save no inconsiderable amount of time in *routine* train operation—possibly equivalent in some instances to the time saved by regradings, cut-offs, and other improvements on the right-of-way that require such large appropriation of capital.

Aerology in the Arctic

THE results of the sounding-balloon observations made by the Franco-Swedish expedition at Kiruna (68 degrees north latitude), in Swedish Lapland, during 1907, 1908, and 1909, have just been published by M. H. Maurice, chief assistant at the observatory of Trappes. Not the least remarkable fact in connection with these observations is that of 72 balloons sent up, 41 were recovered, with their meteorographs. The country about Kiruna is sparsely settled, and the inhabitants are rather primitive. Before the observations were begun, circulars in four languages—Swedish, Finnish, and two Lapp dialects—were widely distributed, announcing the nature and purpose of the undertaking and requesting the finders of balloons and apparatus to return the same intact to headquarters, in consideration of a reward of 15 crowns (about $4). Similar notices were attached to the balloons themselves. Most of the balloons were returned after a considerable lapse of time—in some cases several years. One balloon fell into a lake, where it was recovered after three years. The highest altitude recorded was 22,760 meters (over 14 miles). The height of the stratosphere was found to vary as in temperate latitudes; i. e., it is higher in summer than in winter, and higher over anticyclones than over cyclones.

The Panama-Pacific International Exposition of 1915

Description of the Exposition Site, the Main Courts and the Great Exhibit Palaces

By Hamilton M. Wright

THE site of the Panama-Pacific International Exposition lies within the limits of San Francisco, as a crescent upon the shores of San Francisco Bay, and just inside its "Golden Gate" entrance to the Pacific Ocean.

No more picturesque location could be imagined. On the south, east and west the grounds are encircled by towering hills of varying contours, rising successively from 250 to 900 feet above sea level, like the enfolding walls of a vast amphitheater. Upon the north the site opens out upon the harbor of San Francisco. The panorama recalls the famous Riviera upon the shores of the Mediterranean. In the harbor before the site lies Alcatraz Island, the location of a naval prison, whose white walls are reflected in the waters of the bay. Beyond are the hills of Marin County rising into the hundreds and in some instances into the thousands of feet, with Mount Tamalpais, loftiest of all, its summit often shrouded with a turban of fog upon which the sun shines as upon a vast bank of snow, as a background for the setting. On a clear day, when the wind sweeps in through the Golden Gate, it seems as if one may almost reach out and touch the hills across the harbor. From the west of the site one may look out to the rim of the Pacific Ocean through the mile and one quarter wide straits of the Golden Gate, guarded on each side by rugged cliffs and protected by forts.

The central portion of the site lies slightly above the sea and is encircled on three sides by gently sloping ground; within a short distance from the boundaries of the site these slopes change to steep hillsides, and thus the site becomes the floor of a huge amphitheater, from whose sides the exposition will be seen stretched out below. To the east and south the residence section encircles the exposition grounds, and to the west and southwest the site is embraced by the wooded slopes of the Presidio military reservation, dark with cypress and eucalyptus and interspersed with occasional vistas of green valleys.

The exposition buildings were planned in great groupings to conform to their impressive natural surroundings on the shores of San Francisco Bay. With the sea, the encircling hills, the distant mountains, and the great harbor to blend with and fit into, it was felt by the architectural commission to which was confided this great work, that only the broadest and boldest scheme of construction would do, and so the exposition was planned in huge block effects, all for great beauty and grandeur. The buildings are massed about huge courts to present a single superb architectural theme. The buildings are easily accessible from the courts, a fact of inestimable advantage to exposition sightseers who sometimes grow weary of the long distances to be traversed.

The exposition palaces, built upon an east and west axis, will face the bay upon the north; they will parallel the stream of the great incoming traffic of the world through the western gate of the United States. Ships entering the harbor pass before the exposition grounds where the great buildings are fast arising. The harbor itself will be a part of the great theater upon which will be staged the world's jubilee, and the Golden Gate will be the entrance to the theater.

A marvelous panorama will be afforded visitors on ships coming through the Golden Gate. As one looks from the harbor he will see three main groups of exposition buildings. There will be the great central group comprising the fourteen exposition palaces to be devoted to general exhibits; there will be the group upon the left hand or east end devoted to amusement concessions and covering sixty-five acres. The right hand group upon the Presidio military reservation and nearest the Golden Gate will be devoted to the pavilions of the States and participating nations.

From afar, the central group, the main exhibit palaces, facing for more than a mile upon San Francisco harbor, will present the effect of almost a solid massing of palatial structures, a great walled city, a city of the Orient, with outside walls as high as the average six-story city block and with golden domes and towers rising to heights of 250, 350 and 430 feet. Nearer at hand it will be seen that the exposition palaces are interspersed with great open courts. Three main courts will run north and south through this central group. In general the buildings of the central group are to be brought into contact with those next adjoining by arcades, courts and archways. Through this method of treatment four of the general exhibit palaces of the main group, fronting north upon San Francisco Bay, but set back a distance from the water's edge, will present a single architectural design. Their walls and the adjoining arches will form the main northern façade of the exposition along the shores of the harbor, the marvelous frontage that will be first seen by visitors who reach the exposition city by water and enter San Francisco Bay through the Golden Gate. By day the glittering pillars and minarets of this mile-long façade will be seen as a dream city, while by night they will reflect the sheen of a million lights into the bay.

Before the façade and along the harbor's edge for more than a mile there will be built a great esplanade, a vast stretch of ground and terraces in which fountains will play and groups of statuary be set at intervals. Brilliant flowers and hardy flowering trees and shrubs will lend warmth and color to the esplanade. Indeed, throughout the exposition, flowers and foliage will contrast with the shining colonnades and peristyles and walls of the buildings, and will enhance the beauty of innumerable lagoons, fountains and water effects. The esplanade is to be known as the "Marina" (villa gardens).

The main groups of buildings will lie between a tropical garden or boulevard running east and west along the fringe of the hills nearest the city upon the south and the esplanade along the shores of San Francisco Bay upon the north. The tropical boulevard, to be known as the "Alameda," will be eighteen hundred feet in length and three hundred feet wide; it will be glowing with fountains, lagoons, statuary, peristyles and arcades, and, secluded from the winds of the bay, it will be transplanted with a profusion of semi-tropical trees, plants and flowers, including the orange, banana, olive, myrtle, and every variety of palm. The east end of the Alameda will open out with a plaza upon Van Ness Avenue, one of the principal boulevards of San Francisco. The west end upon the Presidio will be surmounted by a commemorative arch of triumph.

The theme of the exposition, its sculpture and mural paintings, will exalt the spirit of achievement through which America has completed the Panama Canal. In the courts there will be observed monumental expressions in Greek and Roman, Occidental and Oriental architecture. The grounds will become a vast tropical and semi-tropical garden through the transplanting of palms, evergreens and flowers. A brilliant yet harmonious color scheme has been designed by Jules Guerin, one of the best-known authorities on decorative coloring in the world.

The prevailing color tone of the exposition will be an ocher, a tawny buff, several shades removed from white, yet in the distance giving the effect of white; but it will not be glaring under the brilliant sunlight of California. In the courts there will be a marvelous blending of colors; Pompeiian red, strong Italian blues, vermilion and orange will predominate. The court system is unique in that it will permit each architect, artist or sculptor to present some distinct conception, without clashing with the exposition architecture and coloring in its entirety.

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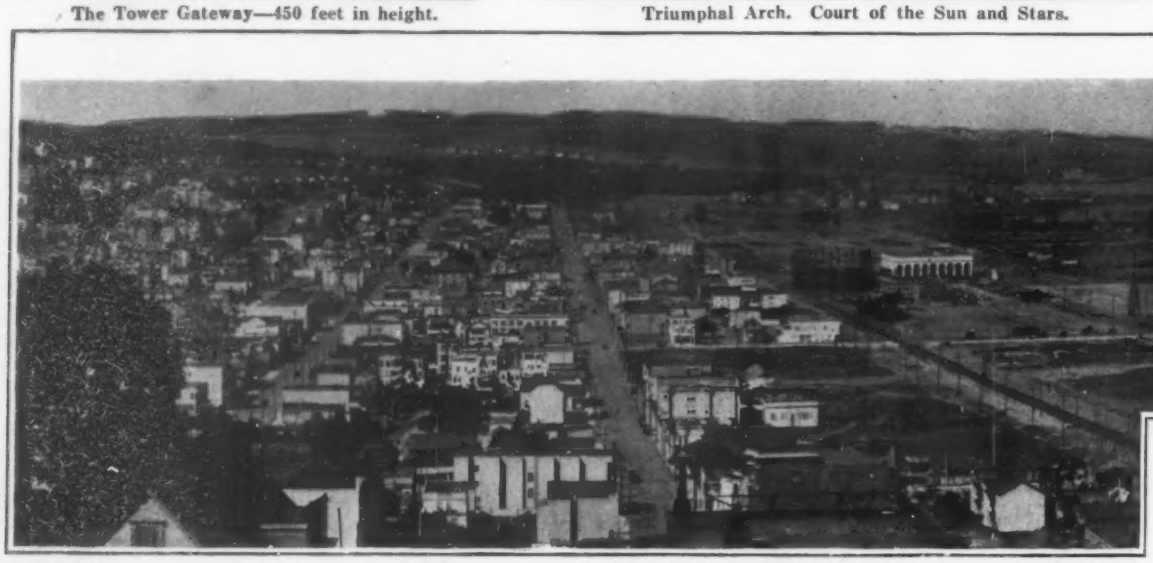
The Tower Gateway—450 feet in height.

Triumphal Arch. Court of the Sun and Stars.

Perspective view of the Exposit

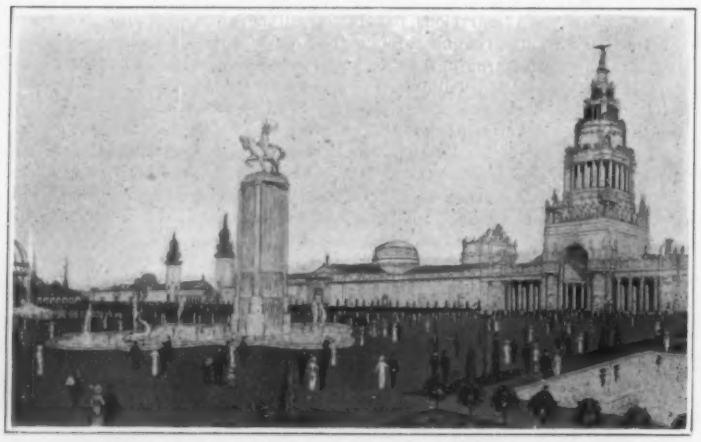
The Panama-Pacific Exp



General view of the Panama-Pacific Exposition grounds.

Machinery Hall in course of constructi

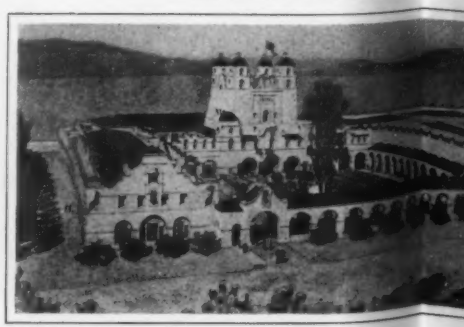
The Horticultural Palace. Dome i



The Fountain of Energy and the great Tower of Jewels.

Photos. Copyrighted 1913 by the Panama-Pacific Exposition Co.

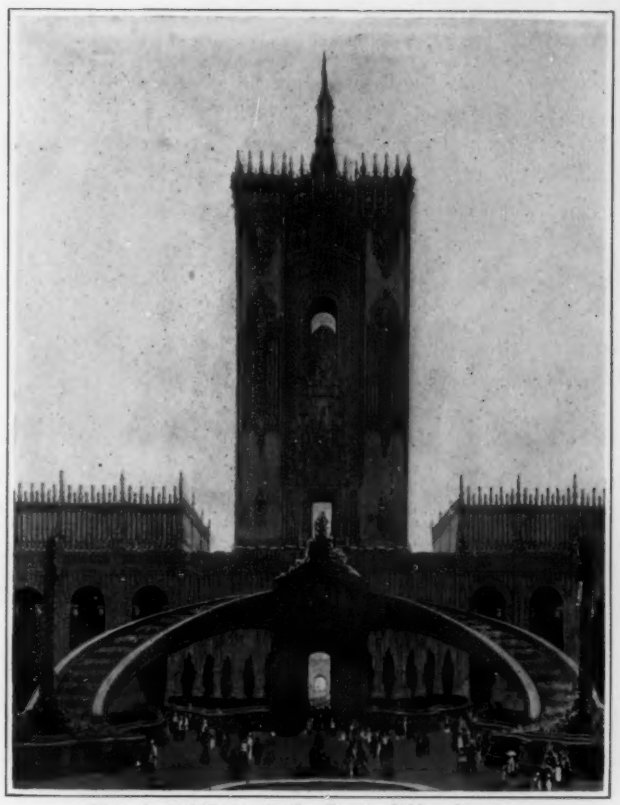
Esplanade on the harbor front of the Panama-Pacific Exposition grounds.



The California Building in the dgnified

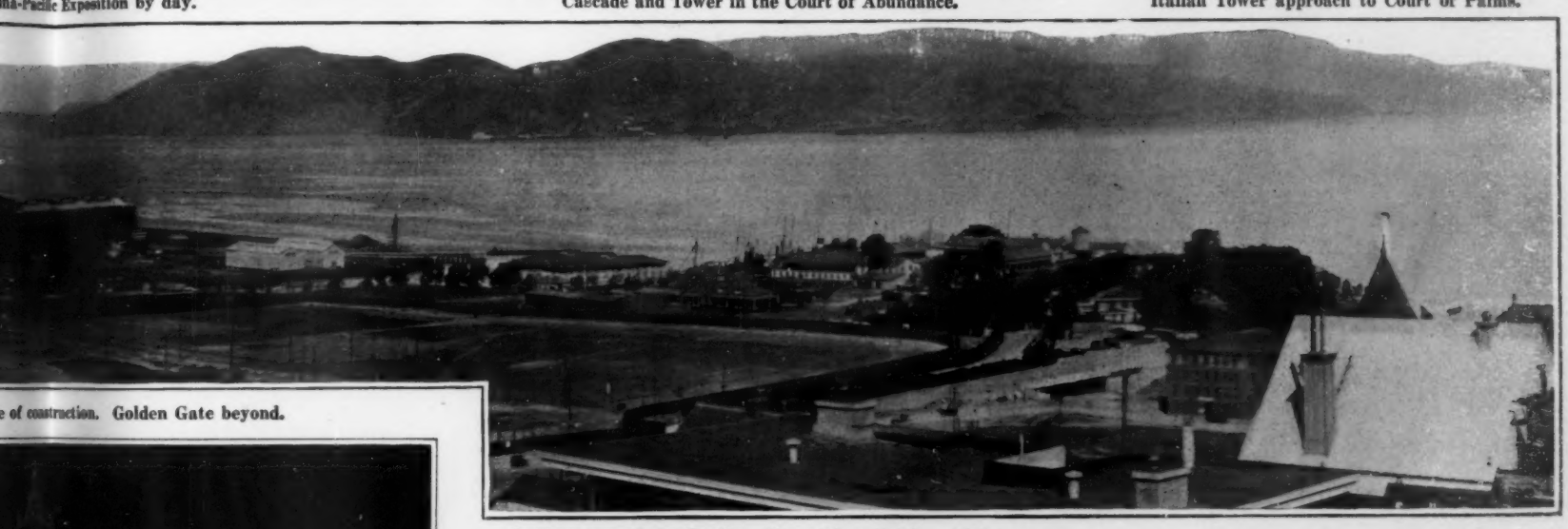
of the Exposition grounds by night.

ma-Pacific Exposition by day.



Cascade and Tower in the Court of Abundance.

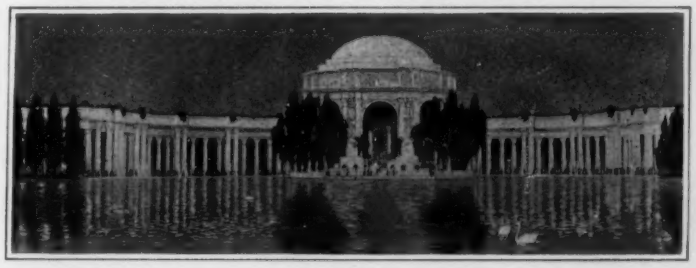
Italian Tower approach to Court of Palms.



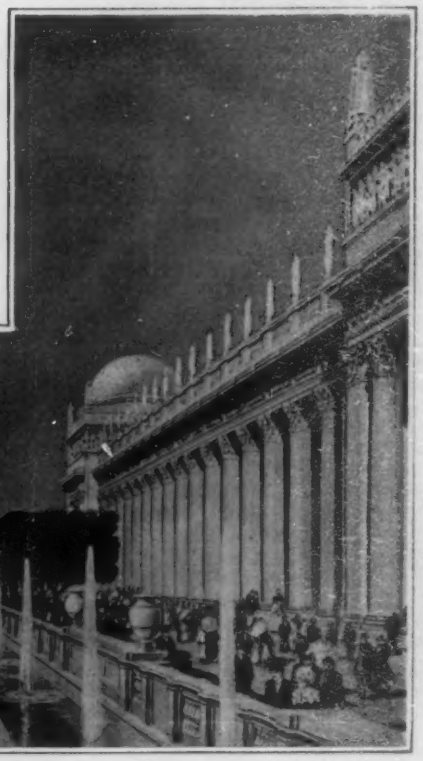
e of construction. Golden Gate beyond.

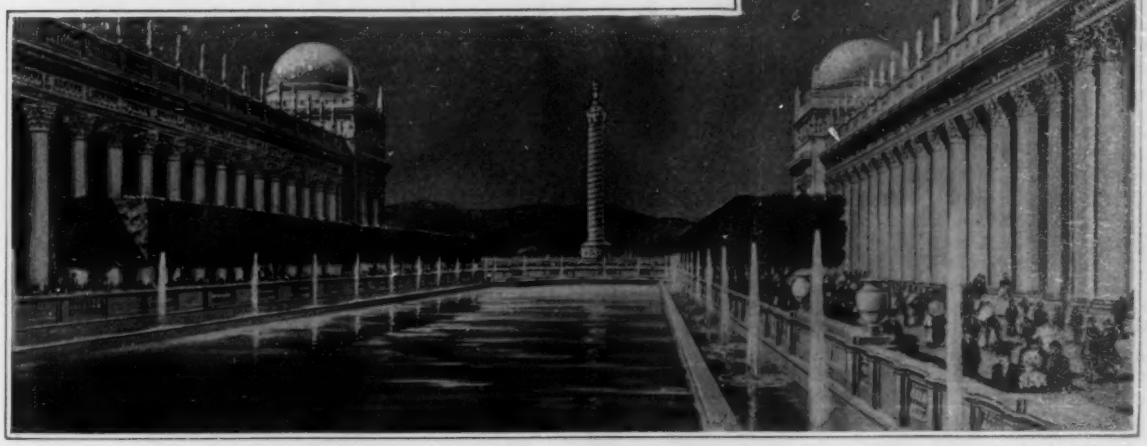
looking toward the Pacific. View taken October, 1913.

lace. Dome is 152 feet in diameter.

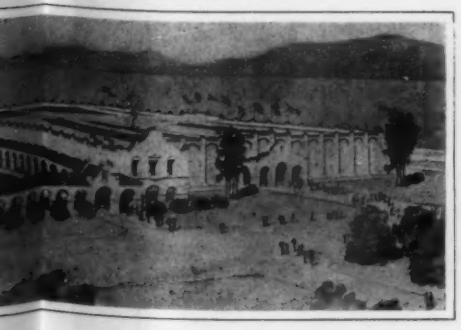


Palace of Fine Arts, the architectural gem of the Exposition.





View through the Court of the Sun and Stars, with Column of Progress in background.



he dignified Mission style of that State.

TERNATIONAL EXPOSITION OF 1915

The main group of exhibit palaces, facing upon the harbor for 4,500 feet, will present practically the effect of a single palace. Eight of the buildings will be joined in a rectangle to form what will amount to a huge Oriental bazaar—a veritable walled city, with its domes, towers, minarets and great interior courts. Four of the eight buildings, as shown by the ground or block plan, will face out on San Francisco Bay and four of them will face the hills of the city on the south.

The walls of the eight exhibit palaces will be broken only by a number of stupendous entrance ways which will give access to the great interior courts and their approaches. The group will be divided from north to south; in the center by the Court of the Sun and Stars, designed by Messrs. McKim, Mead & White of New York; on the east by the Court of Abundance, and on the west by the Court of the Four Seasons. Two south courts will be cut like niches in the walled city, one south of the Court of the Four Seasons and one south of the Court of Abundance. A huge court in Italian renaissance will lie between the rectangle and the Palace of Fine Arts.

Of all the courts the great central court, the Court of the Sun and Stars, 750 feet in width from east to west and 980 feet along its main axis, will be the largest and most imposing. At the south end of the court will be the huge Tower of Jewels, rising 430 feet in height and dominating the architecture of the exposition. The upper part of the tower will take the form of terraces leading up to a group of figures supporting a globe, typifying the world. The tower will be lined with jewels, which will glitter like diamonds when searchlights are turned upon them. At the base of the tower, which will occupy an acre in extent, will be a huge arcade 125 feet high, beneath which the visitor may enter into the Court of the Sun and Stars from the south garden.

In the vaulted archways of the tower itself will be grouped a series of mural paintings, designed by Jules Guerin, and expressing the keynote of the exposition color scheme. But perhaps the most impressive feature of the Court of the Sun and Stars will be found in a superb classical colonnade extending entirely around the court and surmounted by figures symbolical of the stars. These figures, of which there will be 110, will be fourteen feet in height, and each will stand out in radiance through a crown of dazzling jewels of light.

In the center of the court will be a great sunken garden, surrounded by benches to seat about 7,000 people. In the garden will be groupings of classical statuary, dancing figures, fauns, satyrs and nymphs; flowers, trees and vines will contrast with the statuary and with the superb colonnades and towering golden domes.

To the east, as one passes from the Court of the Sun and Stars to the great east court, or Court of Abundance, will be a huge triumphal arch, the Arch of the Rising Sun, 100 feet in height and surmounted by a colossal grouping of statuary; camels, Oriental warriors and the great central figure of an elephant will crown the summit of the great arch. To the west on the approach to the Court of the Four Seasons will be a triumphal arch of like proportions, the Arch of the Setting Sun, surmounted by a group representing western civilization. A huge prairie schooner will comprise the central *motif* of the group.

As one passes beneath either of the vast triumphal arches to the east court, or Court of Abundance, or to the west court, or Court of the Four Seasons, he will traverse great avenues between the exhibit palaces whose sides will be adorned with mural decorations and screened by classical colonnades. Pools of water will reflect pavements of gold. Giant banks of flowers and potted palms will lend color and imagery to the vista.

If the visitor passes to the east, or Court of Abundance, he will behold a vision surpassing the richest dreams of the Orient. The Court of Abundance is dedicated to music, dancing and acting; it is designed for pageantry, and will constitute the proper setting for Oriental or modern drama upon a colossal scale. The architecture of this great court will partake of the Oriental phase of the Spanish-Moorish architecture. Ornamentation upon an elaborate scale will be helped by brilliant lighting effects. Electric scintillators will play upon fountains at night; reflected colored lights will cast a spell throughout the court. The walls of the cloister will be decorated with mural paintings; exotic flowers, trees and vines, orange trees in fruit and in blossom, will contrast with the statuary and the huge colonnades and staircases.

From the Court of the Sun and Stars the visitor in passing to the west will come to the superb Court of the Four Seasons, of which Henry Bacon, designer of the Lincoln Memorial, a monument to be built in Washington, D. C., in honor of Abraham Lincoln, is the architect. In its theme this court will typify the conquest of nature by mankind. In each of the four corners of the court will be cut great niches into the encircling exhibit palaces and in each of the niches will be large mural paintings suggesting the seasons, spring, summer, autumn and winter; lofty colonnades will screen the niches. In the center of the court will be a great grouping of statuary in which Ceres, Goddess of Agriculture, will be shown dispensing the bounties of nature.

The ornamentation upon the waterfront will also be upon a colossal scale. The Court of the Four Seasons, opening upon the harbor, will be entered through a stupendous gateway, the Gate of Columbus. The visitor will pass through the gateway beneath a tower to the esplanade upon San Francisco Bay. Directly before the tower will be seen a colossal figure of Columbus, facing the water. Ornamenting the tower in recesses will be figures representing the great voyagers of the world.

Before the entrance to the great Court of the Sun and Stars upon the bay will be a lofty column, whose spiral will depict man's indomitable impulse toward achievement. At the summit of the column will be the sun. On the left and before the Court of Abundance will be the Gate of Balboa, before which will be placed a colossal statue of the discoverer of the Pacific Ocean.

Each of the three main north and south courts will open out upon the esplanade on the shores of San Francisco Bay upon the north, and upon the great tropical garden upon the south. Vast beds of flowers in bloom will be set in the south garden; the plants will be replaced by others when their flowering seasons are past.

The exhibit buildings, constructed by the Panama-Pacific International Exposition Company and devoted to general exhibits exemplifying the advance of the world in the arts, sciences and industries, will be the loftiest exposition structures ever erected. On the east of the rectangle of eight buildings will be Machinery Hall, the largest single structure of the exposition, covering ten acres. In the south garden at the east end and near the concessions center will be located Festival Hall, and near the west end of the Palace of Horticulture, a huge glass structure, covering five acres and surmounted with a dome 180 feet high. Flanking the rectangle on the west will be the Palace of Fine Arts, a classical and beautiful structure embodying the spirit of the Italian Renaissance. The Palace of Fine Arts will be partly circular in form, with an extreme perimeter of 1,110 feet. It will face upon a great pool in which its outline will be reflected.

Of the three main groups, the one on the east will comprise the concessions or amusement center, which will occupy sixty-five acres and will be the first of all parts of the exposition to be reached by those who come from the down-town portion of San Francisco. Its entrance will be by way of a plaza, at which the concessions district will open out upon Van Ness Avenue. Through the concessions area will run a broad boulevard, the Street of Concessions, more than 3,000 feet long. The domes of the buildings will be illuminated at night and startling electrical effects will contribute to the night life of the exposition at the amusement center.

The western group will include the area occupied by the pavilions of the foreign nations, by the buildings of the States upon the Avenue of Commonwealths, and by the display of the United States Government. The pavilions of the foreign nations, farthest from the bay, will rise in terraces as they advance up the gradual slope of the Presidio military reservation. Nearer at hand and closer to the water will be the buildings of the various States. Each structure in this part of the exposition grounds will present upon a magnified scale the effect of a superb residence district.

Still farther to the west of the area of the States and foreign district will be a great drill ground, capable of accommodating at one time 10,000 troops in drill. Foreign nations will send their crack cavalry and infantry to participate in the maneuvers and trials of skill. Encircling the drill grounds will be a race track, where international speed and harness races will be held. Prizes of $175,000 are offered for live stock; $225,000 for harness races; $45,000 is offered by breed associations.

Marking the extreme western limit of the exposition structures will be the stock pavilions and the buildings devoted to live stock, poultry, domestic pets and other displays. The Government Life Saving Service display will also be located here.

Throughout the entire exposition the illumination will be such as to bring out the colors of the courts in their proper tones, to sharpen and intensify the color effects. The illumination of the colonnades will be accomplished through purple lights, the windows of the exposition palaces will diffuse a golden ray. Giant batteries of colored searchlights will be anchored in the harbor before the site and will play against jets of steam and smoke that will be liberated high in the heavens. Searchlights 500 or 600 yards out in the water, and before the main axis of the exposition, will direct batteries of light over the exposition palaces, going through more than 300 evolutions in color.

The bureau of forestry of the Philippine Islands will send tropical timbers to the United States forest service so that their suitability for fine furniture veneers may be ascertained.

Dirigible and Aeroplane Fleets of the Leading Nations

IT is difficult to obtain at any given time a complete statement of the strength of the various nations in aircraft. The most reliable estimate is that issued for public information by the Office of Naval Intelligence of our Navy, which is herewith presented. It will be seen that the United States ranks far below the leading nations in military aircraft. Our one small dirigible is regarded as "practically useless."

STRENGTH OF THE LEADING NATIONS IN AIR CRAFT.

	Military Dirigibles.	Private Dirigibles (Estimated).	Military Aeroplanes (Includes Monoplanes, Biplanes, Hydro-aeroplanes).		Private Aeroplanes (Estimated).	Aviation Fields.	Pilots (Military and Civilian).	Manufacturers.
			Army.	Navy.				
Austria:								
On hand	5	2	40	6	35	.....	.....	.....
Ordered	3	.....	.....	.....	.....	3	60	5
England:								
On hand	3	3	101	40	154	.....	.....	.....
Ordered	4	.....	47	20	.....	31	382	21
France:								
On hand	13	5	450		1,000	.....	.....	.....
Ordered	7	.....	.....	.....	.....	39	1,200	20
Germany:								
On hand	17	10	152		200	.....	.....	.....
Ordered	5	.....	.....	.....	.....	36	320	15
Italy:								
On hand	8	0	100		100	.....	.....	.....
Ordered	2	.....	30		.....	14	200	.....
Japan:								
On hand	2	0	20		5	.....	.....	.....
Ordered	1	.....	.....	.....	.....	3	20	.....
Russia:								
On hand	9	0	250		150	.....	.....	.....
Ordered	10	.....	0		.....	8	118	.....
United States:								
On hand	(1)	0	20	5	1,000	.....	.....	.....
Ordered	.....	.....	3	1	.....	13	320	6

[1] One dirigible, which is practically useless, is on hand.

The Grashof Medal Presented to George Westinghouse

AT the annual meeting of the American Society of Mechanical Engineers, December 3rd, there was presented to Mr. George Westinghouse the Grashof Medal, which was founded by the Verein Deutscher Ingenieure in memory of Franz Grashof, the famous engineer and professor and author of many important works and the theory of elasticity, general mechanics and machine design.

This medal is given by the Verein only on recommendation of the Council and by unanimous vote in open general meeting of the Verein to men who have rendered pre-eminent service in the field of engineering either in research or in practical activity. It is the highest honor in the gift of the engineering profession of Germany.

Among the men who have received this honor in the past may be mentioned the following: C. von Bach, professor of machine design and one of the founders of the modern theory of elasticity and a leader in the science of testing materials in Germany; Gruson and Schichau, founders of immense engineering plants—metallurgical and machine construction—and ship-building yards from which some of the best German ships, both commercial and war vessels, have since been launched; Gustav Zeuner, whose contributions form such an important part in modern thermo dynamics; Carl von Linde, one of the founders of the refrigerating industry, as well as one of the men who did most for the development of its theory and the understanding of the processes leading to the economic production of cold and liquefaction of air and other gases; Prof. Riedler, well known in the field of steam engineering; Sulzer-Steiner, in whose works many new types of Diesel engines and steam turbines have been developed to commercial success; A. Slaby, known by his work in many branches of electrical engineering; Gustav de Laval, who was also made honorary member of the American Society of Mechanical Engineers, for his invention of steam turbine and centrifugal apparatus of various kinds; Hermann Blohm, one of the owners of the great Blohm and Voss shipbuilding yards, typical of German marine engineering; Prof. Aurel Stodola, one of the greatest authorities living in regard to the theory of the steam turbine, himself an inventor; Count Ferdinand von Zeppelin, one of the most popular and picturesque figures of to-day in the Fatherland, who produced the Zeppelin airship, the pride of the German nation; Prof. Martens, a universally recognized authority on testing materials, and director of the National German laboratory at Gross Lichterfelde West.

Mr. Westinghouse, who is a non-German member in this distinguished society of men, each of whom has fully deserved a page to himself in the history of engineering or the German engineering industry, has thus brought added distinction to the engineering profession in America.

Future Prices of Commodities and Materials

By Alex. Del Mar, Formerly Chief of Bureau of Commerce and Navigation, United States Treasury

DURING recent years, noticeably since the opening of the present century, a remarkable rise of prices has occurred in the Western world; the Eastern hemisphere not being at all affected by it. Nor has the Western world been uniformly influenced; the rise being observable chiefly in the four leading empires, England, France, Germany and the United States, the last especially. In essaying to forecast the future of prices for commodities and materials employed in manufacturing, building and the industrial arts generally, in this country, it is necessary, if possible, to get at the cause of the rise thus far.

On this subject opinions have remarkably varied. In an address to the bankers of Minnesota, Mr. William C. Brown, president of the New York Central, himself a banker, attributed the rise to the increased supply of gold and to "the failure to increase the products of our farms in anything like the ratio of increase in consumption." This he thought exerted thrice the influence attributable to gold. Mr. W. R. Ingalls, in an elaborate essay published in the *Mining Journal* three years ago, and guided largely by the Saurbeck (British) and Bureau of Labor (American) Index Numbers, attributed the rise "to a variety of causes," such as gold production, exhaustion of natural resources, standard of living, monopolies, protective tariffs, demands of labor, and civic congestion. Because no substantial appreciation had occurred "in the Indices of all classes of commodities," but only in some; because no declining tendency was observable in the rate of discount; and because "the ratio of increase in gold has been less than that of iron, copper, lead, tin, and zinc," he concluded that gold, "though not without effect," had not exerted any observable influence upon prices. The principal causes appeared to be the others mentioned above, to which he also added "the demand and supply" of commodities.

In the debates attending the passage of the Payne-Aldrich bill of 1909, and the Underwood bill of the present year, one side attributed the rise mainly to the tariff. This the other denied. In Mr. Payne's great speech of May 2nd, 1910, he even claimed that his bill, though less than a year old, had lowered the price of meats, vegetables, and other commodities, especially those consumed by the poor. His list of tariff "reductions" included 138 specified commodities and classes of commodities. He attributed the rise of prices not so much to the increased supply of gold as to the "reduced cost of gold, owing to new methods of producing it."

With great esteem for the distinguished authors of these various researches, a careful review of the causes alleged does not appear to satisfactorily account for the rise, especially for that greater rise than elsewhere which has admittedly taken place in the United States. All of the alleged causes, except the tariff, have operated in the four principal States of Europe, and even as to tariff, this has been materially raised in all of them except England. Unless by speculation, gold cannot influence prices until it is coined into the money in which prices are expressed; and none of these researches discuss the mint statistics, or the vast shipments to India, where much of it is buried in the earth. No merchandise whose passage through the custom house is made the subject of a tax, pays that tax. It is the importer, the man, who pays; and the relation of his import taxes to the prices of commodities is much the same as that of his excise, or license, or income taxes. He shifts as much as he can upon other people, and they shift back. The eventual result is a general diffusion of taxation. Upon a final analysis it all comes down to the cost of government and the benefits derived from government, both Federal, State, and Municipal; far too complex a subject to be hung on the petty clothesline of a tariff bill. This may do for "politics," but not for political economy. Of the other alleged causes of the rise, such as agricultural production and consumption, natural resources, standard of living, civic congestion, monopolies, wages, rates of discount, demand and supply, it can only be said that they are either too slow, remote, or inadequate to satisfactorily solve the pending problem of prices in the United States. A reminder of national conditions may lead to a more satisfactory explanation.

The population of this country is about 100 millions, of whom nearly 40 millions are engaged in gainful occupations which yield on the average nearly a thousand dollars a year, or 40 billions, with an expenditure of

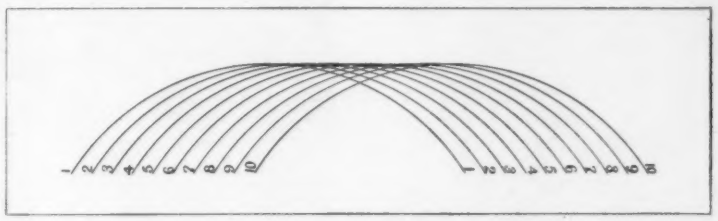


Fig. 1.—Diagram illustrating order of rise and fall of prices of various classes of commodities.

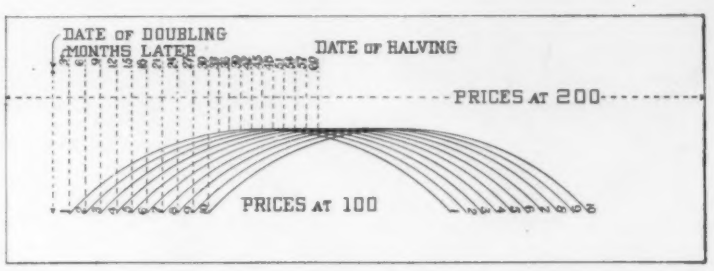


Fig. 2.—Diagram showing that a rise and fall of different prices may occur simultaneously.

35 billions, including about 10 per cent paid for Federal, State and Municipal Government. What has to be furnished is a cause or causes competent to explain a general rise of a third to a half in the cost of living and of probably a fourth in the prices of the commodities employed in the industrial arts. Such collossal sums as the above cannot be explained by any of the causes advanced: these are altogether too trifling. Something else, something hidden, unlooked for, unexpected, must be discovered, to account for the immense rise of prices in recent years. Moreover, it must be a cause which has especially affected the United States.

If under man's supervision and with no additional

(Concluded on page 446.)

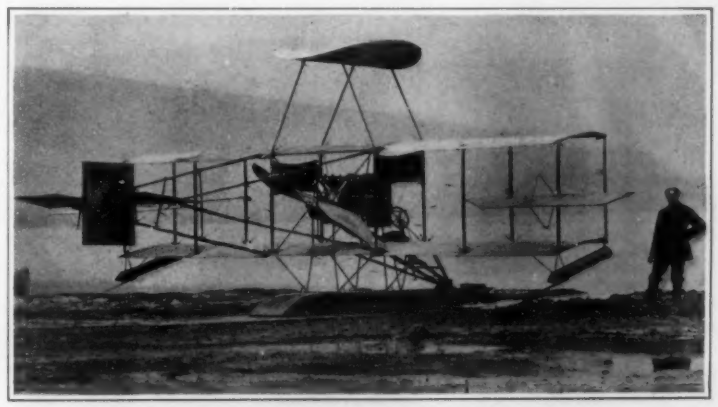
A Dished Disk Stabilizer

SOME time ago there appeared in our column of Aeronautical Notes a brief description of a stabilizer which had just been patented, and which consists of a disk slightly dished and mounted above the plane of an aeroplane. Shortly after the inventor of this apparatus brought in a small working model which demonstrated very conclusively that the apparatus would bring the aeroplane to a level position no matter in what direction it was dropped. Since then, the inventor, Mr. H. C. Fiske, has had the stabilizer attached to a full-sized machine in order to prove its worth. Mr. William S. Luckey, of the Curtiss School, who, it will be remembered, carried off the first honors in making the circuit of Manhattan Island on Columbus Day, fitted his machine with one of these stabilizers. It was a crude affair built hastily under Mr. Fiske's direction. It consisted of a disk of canvas seven feet in diameter with the sides curved upward ten inches from the horizontal at the extremities. The device weighed 11 pounds. The form of the stabilizer and the method of mounting it upon the hydro-aeroplane are clearly shown in the accompanying photograph. With this device Mr. Luckey made a number of trial flights, which he declared to be very satisfactory. He writes: "I find under medium speed, the aeroplane to be very steady without use of the ailerons. I also found it very effective at high speed in straight flights and medium large circles. It was not necessary in any of this work to use the ailerons. The machine banked and handled very nicely in calm air and in a wind of thirty miles velocity."

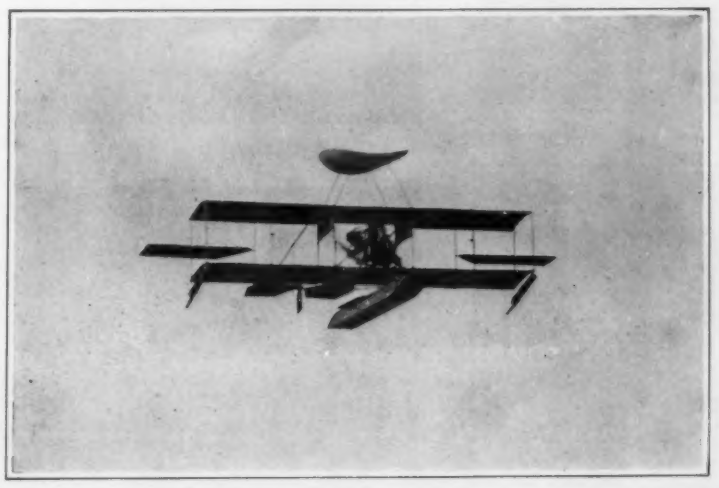
One might contend that a stabilizer such as this would increase the head resistance of the machine, but it was found in actual practice that the speed was not affected materially, and if, as Mr. Luckey claims, the ailerons could be dispensed with, the head resistance would be materially reduced, for the ailerons undoubtedly act as brakes.

The device is so simple that it hardly needs any explanation. The curve of the stabilizer is such that if the machine starts to drop sidewise, the air banking up against the lower side of the disk will bring it back to level. When making a turn the machine banks automatically, for the lateral drift due to centrifugal action brings air pressure against the side of the disk and causes the plane to lift on the outer end. Even with the crude stabilizer, the aeroplane showed a great deal of stability against pitching. This could be materially increased by dishing the stabilizing disk as in the small model. Mr. Luckey found that he could land or alight upon the water at a much reduced speed.

One of the accompanying illustrations, which shows the machine in flight, was taken after it had made a swoop from a considerable altitude in order to come down within the range of the camera. At the time it was traveling at a speed of about 70 miles per hour. Heretofore it has been necessary for the aviator to be constantly working with the ailerons to keep his machine from being affected by sudden gusts of air. Apparently with the new stabilizer he need not bother with the controls and the operation of the machine is greatly simplified.



Curtiss hydro-aeroplane fitted with a disk stabilizer.



In flight, without using the ailerons.

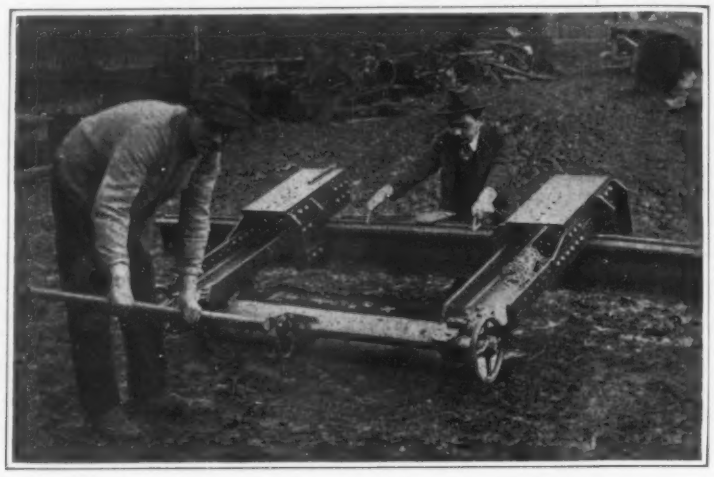
Building the New Capital of India

ALTHOUGH nearly all the government offices in Calcutta have now been abandoned, little progress has yet been made toward the construction of India's new winter capital, which is to occupy a site of three or four square miles adjoining the present city of Delhi, and for a year or two most government work is to be carried on at Simla the year round, though the viceroy and other important officials are spending the present winter at Delhi. About 25 miles of tramway are being laid about the site of the new city. It is understood that the Imperial Delhi Committee estimates the cost of the new capital at about $20,000,000, though the impression prevails in India that the cost will be double this amount. About 6,000 men are now working on the site, and when the work is in full swing from 15,000 to 20,000 will be steadily employed. An incidental task will be the improvement of sanitary conditions in the old city.

Inventions New and Interesting

Simple Patent Law; Patent Office News; Notes on Trademarks

Lever machine for bending rails.



Ascertaining the curvature by means of the bend gage.

A Novel Rail Bending Machine

By Our Berlin Correspondent

A RAIL bending machine, in order to be thoroughly suitable, should exert a uniform bending moment of proper magnitude on every point of the rail. It should also be easily transportable, thus avoiding the necessity of transporting the rails to be bent.

In most bending machines so far in use, the rail is laid on two supports and a pressure exerted between these on the rail. The bending moment at the points of support thus is *nil*, rising uniformly toward the point of pressure, where it reaches its maximum value. It is therefore necessary, in order to obtain a uniform bend, to shift the points of support and the point of pressure along the whole length of rail or (as in the case of bow bending machines) to apply the machine at brief intervals.

In the new lever bending machine designed by Richard Peukert, of Haida, Bohemia, the power acts on the rails on both sides, outside the points of support, and in such a way as to keep the moment between these points constant, so that the rail may be circularly bent over the whole intermediary length. The action on the levers is exerted by a screw winch. The leverage, as well as the pitch and arrangement of the screw, are so chosen that the loss of power is reduced to a minimum. The machine is operated by two men as follows:

After the levers have been laid over the rail head at sufficient distance for the screw winch to be attached while the nuts are slackened, the lever ends are pushed apart and the winch is drawn together by actuating the ratchet. On next releasing the winch, the ratchet pawl is turned over, and the winch turned back, first by means of the ratchet and afterward with the aid of the hand wheels. The machine is then suitably connected together by two chains and drawn forward to another working section, viz., the distance between the two lever centers. After the first operation, the bend must be checked by putting on a template or measuring the pitch.

When using a Peukert bend gage, both the concave and convex curvature can be ascertained by determining the pitch from a meter chord. The bend is then gaged most accurately by stopping the apparatus, while drawing together the machine. When a certain experience has been gained, a bend, including the shifting forward of the machine, will be effected in three minutes as a maximum.

In installing a railway a short time ago, all curved rails (180 millimeters in height and 150 millimeters in width at the lower flange) were bent by means of the Peukert machine. The bending operations were carried out on the spot, the average daily output with a ten hours' working day being 180 meters of finished bent rails with a radius ranging from 20 to 50 meters.

Soldiers' Universal Tool

THE accompanying illustration depicts a very interesting tool particularly adapted for the use of soldiers. It consists of but three parts with two interchangeable pins, yet it may be converted into over a score of different tools. The stock of the tool is provided with a handle that is electrically insulated, so that the operator need have no fear of electrically charged wires. The broad blade is provided with a keen cutting edge, and may be attached in different positions to the stock, so as to serve as a hatchet, adz, or spade, depending upon its plane with respect to the handle. One of the illustrations shows the blade employed as a shield to protect a rifleman. Mounted as a hatchet, the tool may be safely used for breaking down wire obstructions. A pick attached to the stock may also serve as a handle for pliers, pipe wrench, wire cutters or wire twisters. With the broad cutting blade removed from the head of the tool, we have a hammer as shown in one of the views. The stock is provided at one side with a file, and is graduated along one edge so that it may be used as a foot rule. A projecting part may serve as a screw driver and also as a can opener. The number of uses to which the tool may be put is apparently endless.

The head serves as a hammer.

The tool makes a good wrench.

The hatchet as a shelter.

The stock is formed with a file surface.

The tool as a spade.

Cutting a barbed wire entanglement.

Incombustible Linoleum

THE manufacture of incombustible linoleum, or, to speak more accurately, of linoleum that burns with difficulty has been a goal long aimed at by linoleum factories. The attempts previously made have been based on the plan of adding incombustible matter, such as asbestos or ammonium salts, to the mass during the process of fabrication. Far more promising is a new scheme, described in *Technische Monatshefte*, in which magnesium carbonate is added to the mass. All the carbonates have the property of giving off carbon dioxide when heated at high temperatures. This, as is well known, is a very heavy gas, which does not rise, but creeps along the floor. For this reason in case of a fire it would tend to cut off the supply of air from the linoleum. Magnesium carbonate is chosen because it breaks up at lower temperatures than any other carbonate. The principle involved is, of course, one commonly used in the manufacture of chemical fire-extinguishers.

A Proposed Bureau of Labor Safety

A BILL has been introduced in Congress seeking to create a bureau of Labor Safety in the Department of Labor with a special reference to investigation and examination of labor safety plans and devices. Such a bureau if instituted should give an impetus to the production and development of improvements in such devices for factory and railroad use, in fact wherever labor is employed. With more than six million factory employees and one million six hundred thousand railroad employees in the country, the demand for labor safety devices should be earnestly developed and their introduction and maintenance strictly enforced. No one is more interested in the provision of safety devices than the laborers in the particular industry to which the special devices relate and the demand sought to be created by legislation should receive attention from the workers themselves.

Non-splintering Glass

A VERY ingenious process for producing glass which will not splinter and fly about when broken has been devised, according to *La Nature* by a French inventor. One side of each of two glass plates is covered with a thin coating of gelatine, a thin clear plate of celluloid is laid between these two surfaces, and glass and celluloid are then united by strong pressure into a single pane.

The "triplex pane" thus produced is said to lose little in transparency while it gains the valuable quality of not splintering when struck or pressed against. While

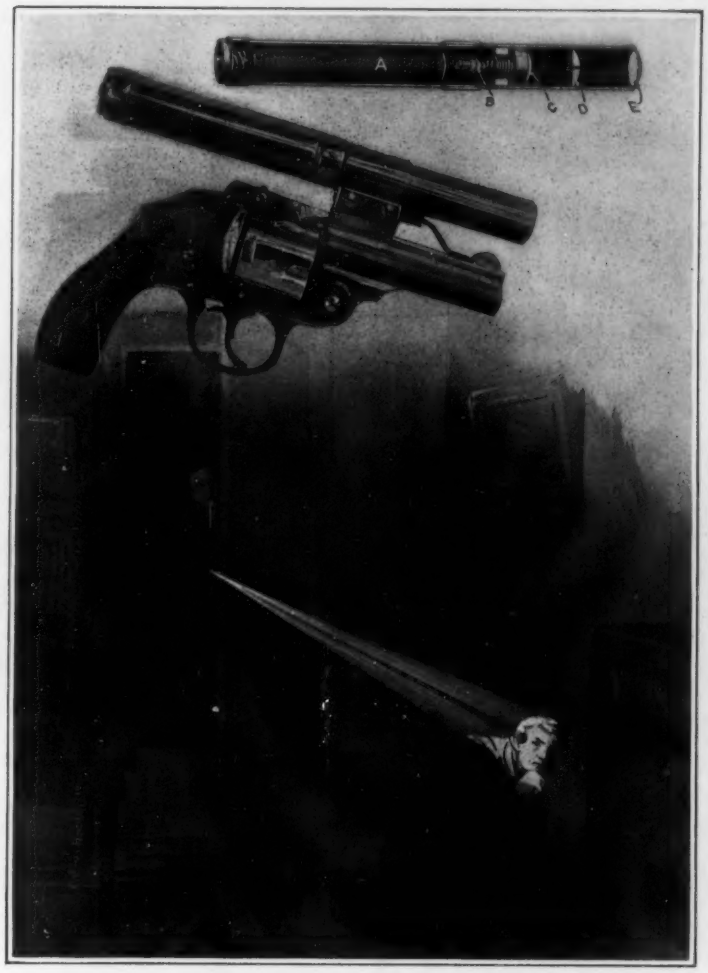
it does not become unbreakable the fragments do not fly, being held by the gelatine layer, and hence no damage is done to bystanders from flying shards.

Tests showed that the most violent blows with a hammer merely caused radiating cracks and concentric rings of cleavage.

Searchlight Revolver

THE average householder is seldom a good marksman and yet at any time he is liable to have to cope with an intruder who is an expert with firearms. Hence, it is quite essential that he be provided with something to overcome his handicap. The burglar usually has the advantage in knowing the general direction from which the man of the house will approach, whereas in looking for the intruder one never knows in what particular nook he may be hiding. Revolvers provided with flash lamps have been invented which enable a man to light up a dark room suddenly and discover any intruder, but such a revolver places one at the mercy of the thief, while the light is wavering about the room in search of him. To take aim, the householder must bring his eye into alignment with the revolver, so that the thief has but to fire at the source of light to be sure of getting his man.

An improvement on that form of revolver has recently been introduced, which makes it unnecessary for one to stand directly behind the gun. The cone of light thrown out from the searchlight contains a black center which indicates the spot that will be hit by the bullet, so that a man hiding behind a door or piece of furniture and peeping around to take aim, may hold the gun far to one side, so as to mislead the burglar as to his position. As long as the black spot is on the intruder the householder knows that his revolver is properly trained. The accompanying illustration shows a revolver with the improved searchlight attachment and also a sectional view through the searchlight. It will be found to consist of a battery *A*, a mercury switch *B*, lamp *C*, and lenses *D* and *E*. The lens *D* is perforated so as to form the dark spot above referred to. The mercury valve consists of a small glass vessel in the shape of horizontal 8. Normally the drop of mercury within the vessel lies in the forward compartment. But on raising the gun sharply, it flows past the central constriction into the rear compartment and closes the circuit between the lamp and the battery. When it is desired to disconnect the lamp permanently, a knurled thumb piece at the rear end of the flashlight is turned, breaking the connection between the casing of the flashlight and the rear terminal of the battery.



Searchlight that shows where the bullet will strike.

A Gasoline Motor Plow

By Frank C. Perkins

THE accompanying illustration shows a gasoline motor plow designed and constructed at Bedford, Va. The engine is of two cylinder type and develops nine horse-power.

The plow is provided with a truck attachment and will haul 1,100 pounds up a 6 per cent grade. It steers with both front and rear wheels and with the reverse can turn as sharply as an automobile. This attachment adapts the machine for all operations from breaking the land, to the planting and cultivating of the crop and the hauling of it to market. The machine is equipped with two speeds, one for plowing and cultivating the other for road work and hauling, either of which can be varied greatly by the throttle at the will of the operator.

The plow pulls a two horse turning bottom, cutting eight inches deep and twelve inches wide. When cultivating, the cultivators are hooked up behind with a jointed lever, the small rear wheels cut in one direction and the front tractor wheel in the opposite direction, and the machine is turned short, at the end of the row. When breaking land with a turning plow, to make the quarter turn at the corners the plow is reversed three or four feet, in which space it turns shorter and in about half the time required by horses.

The motor of the plow can be thrown into and out of gear and the speed regulated without letting go of the handles. The two, large, spiked drive wheels pull the plow, the engine being geared to these wheels. The plow holds the drive wheels to the ground and the spikes prevent them from slipping, so that the machine works equally well in sod, soft ground, loam or sand. It is a practical machine in rough land. When the plow strikes a root, stump or tight rock, instead of straining or jerking as horses would do, the spiked wheels slide and the machine can be thrown out of gear instantly. It is then easily raised by the handles, as quickly thrown in gear again, and passes over the obstruction.

Included in the attachments used with the plow are the turning points for breaking land, a seeder for planting corn, cotton or other seeds, dropping them in rows or hills, cultivators, which include disc-harrow, weeders, listers and sweeps. A spraying attachment including tank and pump, may be mounted between the handles for spraying trees, or crops in rows and potatoes, two rows at a time. A mower cutter bar and rake attachment will prove useful in harvesting small crops of hay, clover, peas, etc.

A Three-Axle Water Ballast Motor Roller

ONE of the most outstanding features of the recent International Roads Congress Exhibition held in London, was a new type of water ballast motor roller. The distinguishing feature of it is the introduction of a third axle and roller. It is the joint invention of Col. Crompton, the eminent British motor and road authority, and Mr. Tapp.

The three-axle roller is designed expressly to produce a level or regularly curved surface, as free as possible from the harmonic recurring waves or depressions which may occur to some extent with the ordinary two-axle roller.

The essential feature of the invention comprises the three cylinders filled with water, carried on three axles and attached to a rigid frame. The general disposition of these rollers may be gathered from reference to the accompanying illustration. It will be seen that the frame ends in a pivot at either extremity to which the outer rollers are attached, and both are steering cylinders, the rear cylinder moving relatively to the front cylinder. Only the center roller, which is the driver, is spring mounted.

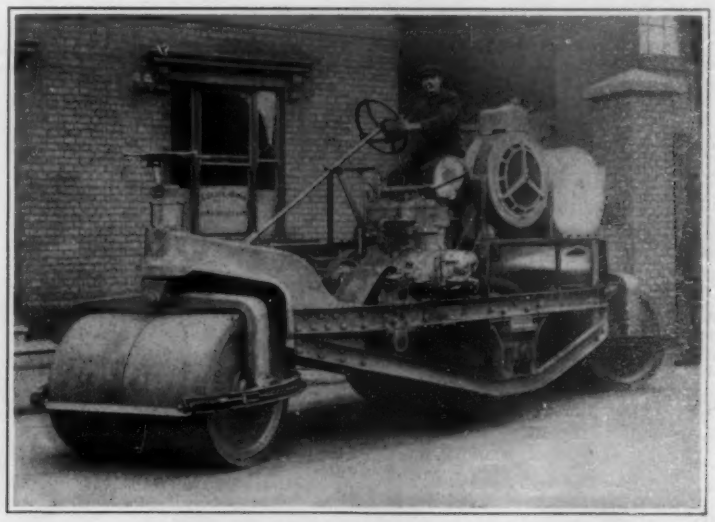
The motion of the driving central axle in an upward direction is limited by stops which can be brought into action when and as required, the roller then being free to fall below, but not above an adjustable fixed point relative to the two end rollers. The adjustment of this point and variation in the distribution of the weight upon the three axles is effected by means of a special form of screw adjustment operated by the hand wheel on the front fork head carrying the leading roller.

The total weight of the roller, shown in the illustration, in light running order without water ballast, is 22,384 pounds. With water ballast in the rollers and a full tank the total weight is increased up to a maximum of 27,600 pounds. But the weight is distributed in such a way that at no time is the weight on the front roller less than 1,904 pounds in excess of that imposed upon the rear roller, this being necessary to prevent both front and rear steering rollers from leaving the ground.

The adjustable variation in roller pressure enables a single roller of this type to carry out the work of both light and heavy rollers of other types, and makes it eminently suitable for rolling asphaltic or tar-macadam surfacing materials, the minimum rolling pressures being utilized during the early passages of the roller over the surface, while for final consolidation the rolling pressure can be increased up to any desired extent within the limits of the machine.

The use of the stops, which prevent the center spring mounted roller rising above a predetermined point in relation to the end rollers, overcomes the formation of

Motor plow cutting an eight by twelve-inch furrow.



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harmonic waves in the rolled surface because, in passing over the ridge or crest of a wave, increased pressure is brought to bear on the road surface at this point automatically by the center roller, forcing the surfacing material down into the hollow or depression, over which, by virtue of the spring action, the roller then passes with a decreased rolling pressure. The production of harmonic wavy surfaces is obviated still further by unequal spacing of the three axles, the distance between centers of the front and center axles being greater than the corresponding distance between centers of center and rear axle.

Notes for Inventors

Photographing the Band-master for the "Movies."—Patent No. 1,069,221, to Jacob Beck, Munich, Germany, provides for synchronizing a moving picture and a musical accompaniment thereof by photographing on the film the performance of the actors and simultaneously photographing on the same film a reflected front view of the band-master directing the musical accompaniment. The band-master's photograph is so disposed that it may be obscured from the front of the screen and shown at the rear, so that the photographically reproduced leader may direct an orchestra or band located in the rear of the picture.

A Two-part Bottle.—A divided bottle has been patented, No. 1,064,442, by John E. Cadigan of New York city in which the bottle is composed of top and bottom parts, the top part having a neck and being open at the bottom and the bottom part being open at the top and a central part which forms the bottom of the top part and the top of the bottom part has annular grooves to receive the respective parts.

Paper Overshoes.—Morris H. Siegel of New York city, has secured patent No. 1,068,942, for a shoe whose sole, side, toe and heel pieces are made in one piece from paper with each side piece folded about opposite the ankle to provide gore sections which may be folded to contract the opening in the shoe to hold it upon a shoe on which it is fitted, means being provided for fastening the gore sections when so folded.

A Reinforced Kinematographic Film.—Charles Dupuis of Charenton, France, has secured a patent, No. 1,068,747, for a kinematographic film, It consists of a band of strong paper having openings and photographs on gelatine in said openings so that the film is of uniform thickness throughout, the feeding perforations being cut upon the edges of the paper in proper relation to the images.

A New Base-ball Score Board.—In a patent, No. 1,069,920, George S. Coleman of Washington, D. C., shows a score board provided with representations of a human figure arranged in succession. Light may pass through the figure. Attitudes may be assumed which correspond with those of a player while in the act of moving from one point to another. An illuminating device is passed in rear of the representations in succession to produce the effect of a person moving in the direction of the series.

Combined Can Opener and Pouring Spout.—In a patent, No. 1,069,388, Lewis Colwell of Chicago, Ill., shows a can-puncturing and pouring attachment in which an annular band in sections has one of the sections provided with spurs to puncture the can, another section provided with a pouring spout, with a cutter adjacent to it to puncture the can forming an outlet to the spout and with levers connecting the sections so that they can be drawn together to secure an opening of the can.

Living on an Expired Patent.—A Washington wit when recently asked what a friend, who eked out a precarious living, was doing, replied that he thought he was "living on an expired patent." He evidently thought this was funny and did not realize how many people made very good livings indeed out of expired patents and the writer recalls instances where the inventor made more money out of the invention after the patent expired than he did during the life of the patent.

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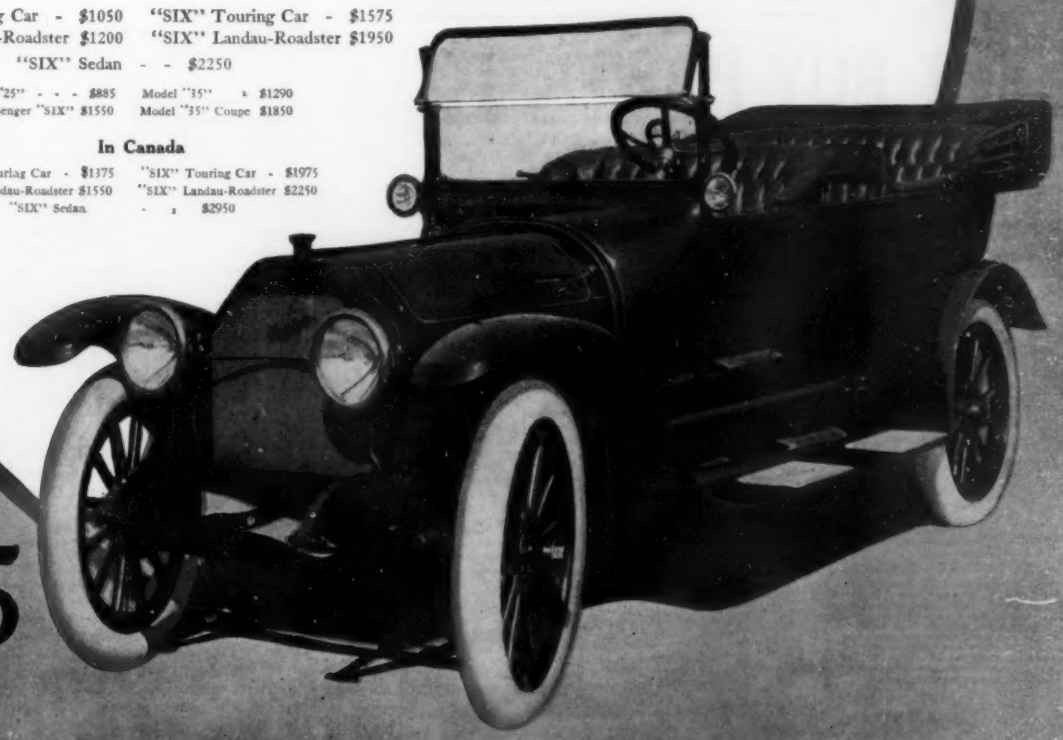

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RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Pertaining to Apparel.

SOLE BRIDGE.—J. D. MANBLATT, 90 John St., New York, N. Y. The primary object here is to so improve arch supports or bridges of boots and shoes as to make them cheaper in construction and more efficient in use than devices heretofore proposed for this purpose. The main portion is made of wood, and hence is cheap, light and rigid, and possessed of sufficient strength to resist breaking or distortion.

HOSIERY.—D. O'DONNELL, 559 W. 171st St., New York, N. Y. The object here is to provide improvements in knit socks, stockings and like knit articles whereby such articles can be easily worn and held up in proper position without the use of separate devices such as garters, hose supporters, and the like.

Of General Interest.

VERTICAL FILE FOLDER.—M. B. JACKSON, P. O. Drawer 758, Victoria, B. C., Canada. Among the objects here is to provide a filing device which will reduce the tendency to misfile papers, means being provided as to necessitate the opening of the file in order to introduce additional papers, but which locking means is of such a simple nature as to require but a moment's time.

STILL.—H. B. PHILLIPS, Fairmount, N. C. The invention pertains to improvements in stills, more especially those used for the production of turpentine. It provides a device in which pine wood containing turpentine may be treated without any danger of overheating the wood. The device is of a portable nature and may be readily set up in one section and moved to another.

ARTIFICIAL BUTTERFLY.—F. SHELINE, New Kensington, Pa. The purpose of the inventor is to provide a construction in which a butterfly may be caused to take substantially any pose and be readily secured in place whenever desired. Another object is to form artificial butterflies of various colored cloth or other material, so as to match with different surroundings.

POST ANCHOR.—P. T. BAILEY, Newport, R. I. The intention here is to provide an anchoring base for posts which may be readily placed in position on posts, the parts being so formed as to require a minimum amount of work in assembling and properly positioning the posts and anchors in the ground.

BRUSH.—A. L. HOLTZMAN, 1524 Chestnut St., Philadelphia, Pa. The invention provides a brush arranged to permit the user to conveniently and quickly replace a worn out bristle holder by a new one and to allow thorough cleaning of the holder and the support thereof with a view to keep the brush at all times in sanitary condition.

Hardware and Tools.

DOOR LOCK.—F. WARCUP, Westernville, N. Y. This invention relates to improvement in door locks in which the door is made to open and close simply by a slight push or pull on the handle, and can be attached to or removed from the door more simply and more easily than the common lock.

Heating and Lighting.

ELECTRIC WATER HEATER.—R. C. BOYER, 1935 Pepper Ave., Lincoln, Neb. The essential object here is evolved in the provision of a heater which includes in part an arrangement of circulating coils of pipe on an arrangement of heating elements disposed within a container, whereby as the water circulates through the coils, it will be instantaneously heated.

CHARGING APPARATUS.—H. J. ROWE, 1261 Victoria Ave., New Kensington, Pa. The invention comprises a device for charging furnaces by supplying fuel and other materials thereto, and it comprises certain improvements whereby the load can be carried to the supply opening of the furnace and automatically delivered to the interior of the same as soon as the carrier on which the load is placed reaches the supply opening.

Machines and Mechanical Devices.

BELL.—J. L. ROYCOURT and L. HORINKO, care of Improvided Mfg. Co., 32 Union Square, New York, N. Y. This invention relates to improvements in bells, and has for an object to provide an improved structure of simple, strong construction with a minimum number of parts and positive movement of the striking members upon the actuation of the operating button.

PLUMB BOB.—J. GAMBLLEE, Tenafly, N. J. An object of the inventor is to provide a bob, the body of which is adapted to house the cord by which the bob is suspended while in use. Another is to improve the construction whereby the drum on which the cord is wound when housed within the device may be manipulated either to withdraw the cord, to return the cord into the bob, or to lock it at any desired length.

DIPPER FOR STEAM SHOVELS AND DREDGES.—C. BUTLER, 1170 Broadway, New York, N. Y. This invention has reference to excavating or dredging machinery and has particular reference to certain details of construction of dippers. The primary object is to improve the form of teeth as to the means of securing them to the cutting edge or the front of the dipper. The invention also improves the locking means for the door.

DRILL BIT LIFTER.—M. MCCARTHY, Oxford, N. J. In this patent the improvement has reference to well-boring machines, and the object is the provision of a new and improved drill bit lifter to enable an operator to readily raise and sustain the drill whenever it is desired to couple or uncouple the drill rod and bit.

MECHANISM FOR ROTATING AND LOCKING THE CYLINDERS OF REVOLVERS.—E. GUERRERO, Antigua, Guatemala. This invention is a simple mechanism connected with, and operated by the trigger of a revolver, whereby the cylinder is rotated intermittently of its step-wise movements, so that safety from premature or accidental discharge of the weapon is insured.

MOLD FOR MAKING CONCRETE WALLS.—E. A. ISLES, 846 Hancock St., Brooklyn, N. Y., N. Y. This invention relates particularly to a machine or mold for use in the forming of concrete floors, walls, partitions and the like. The mold is of that type in which the walls of the mold are raised successively as the wall is built up in thickness, and may or may not be supported by the lower portion of the wall already built.

Pertaining to Recreation.

SKATE CLAMP.—T. SPACIE, 154 Greenwald St., Blue Island, Ill. The object here is to so construct the clamping mechanism of a roller skate as to produce an article combining the elements of strength, cheapness, reliability and ease of manipulation, having reference particularly to the bracing connection between the clamping screw and the means for supporting the front wheel axle.

Pertaining to Vehicles.

WHEEL WITH MULTIPLE AND BALANCED RIMS.—H. LOTTE, 4 Rue Pascal Bourcy, St. Jean d'Angély, Charente-Inférieure, France. The invention relates to improvements in the wheel with multiple and balance rims making the subject-matter of the United States patent application filed December, 1907. The wheel comprises a main rim and auxiliary rims connected to the preceding one by beams arranged so that the auxiliary rims may be capable of being displaced vertically and horizontally relatively to the main rim.

AUTOMATIC JACK.—J. T. DILLON, 11 Reed St., Port Chester, N. Y. The object in view in this invention is to provide an improved construction and arrangement adapted to be secured to the axles of an automobile or other vehicle for acting in a plurality of capacities, as for instance a jack, an emergency wheel, and a turn table.

DEMOUNTABLE RIM.—W. F. JENKINS, 900 E. Clay St., Richmond, Va. This device is of simple construction, but will positively hold the demountable rim in place when the latter is secured to the fixed rim. The invention provides a demountable rim which is split at one portion thereof, with means adjacent to the split portion for drawing the latter tightly together and firmly holding it in place.

CARBURETER.—W. ELKIN, 107 Buckner St., Winchester, Ky. In the carbureter patented by this inventor a valve casing and cylindrical valve are provided being both formed with annular series of air inlets and annular series of fuel inlets, and admission to these inlets is controlled by the movements of the valve longitudinally, a governor being provided, acting on the valve in one direction, and a spring exerting pressure on the valve in the opposite direction. The air and fuel admitted to the interior of the valve, pass to a mixing chamber and thence to the cylinder.

VEHICLE TOP SUPPORT.—BELDIN C. SMITH and D. HORVITZ, care of the former, 729 Congress St., E. Detroit, Mich. The aim of this invention is to provide bows for tension tops of buggies, automobiles, etc., which do not necessitate the use of bolts or pins, but which are provided with sockets arranged to receive lugs so that the bows may be immediately shifted without the necessity of withdraw bolts or cotter pins.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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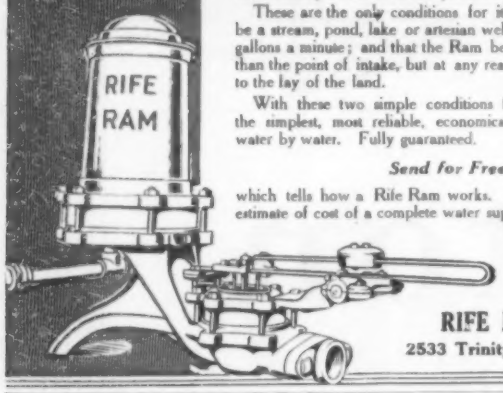

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The Origin and Evolution of Man

(Concluded from page 431.)

this introduces new problems into our study of human evolution. It shows that evolutionary changes are not correlated in the human organism. That, of course, had been known before; but no such striking and radical illustration of the fact has ever previously been discovered.

It undoubtedly suggests that certain changes may occur comparatively suddenly according to the mutation theory of DeVries. This, and the fact that such highly developed skulls as that of the Galley Hill man mentioned at the opening of this paper existed 200,000 years ago, force us to conclude that there have been sudden changes somewhere in the course of man's evolution, or that his origin as man must be placed back into an abyss of time that it is appalling to contemplate.

The Enlargement of Sculpture

(Concluded from page 426.)

point and so adjusted that no matter how the arms move these two points always remain in the same straight line with the fixed point. These two movements—of the shaft and of the arms—make it possible for the extremities of the arms to touch any points whatever even in a complicated group and its enlargement.

When the small plaster model has been put in place and the armature for the enlarged figure constructed and the core built out to within about two inches of its finished size, points are marked on the small model, many or few, according to the amount of detail. When the finger of the shorter arm is placed on one of these marked points, the finger of the other arm will indicate the corresponding point in the enlarged figure. A long, slender nail is then driven into the enlarged figure so that the head exactly touches the point of this longer arm. The number of points that must be taken depends upon the amount of detail. But if the enlargement is of a head, for example, many points must be taken about the face where there is a great amount of detail. The sculptor fills in with clay, plasteline, or plaster, being guided in finishing the surface by the heads of the slender nails. Having thus the general form of the figure he can finish details of the surface as he desires. Both the plaster model and the armature of the enlargement are mounted to revolve on parallel, vertical axes, and the mountings are geared together by chain and sprocket, as shown in the drawing, so that all parts may be brought within a range of the pointers.

The inventor of this enlarging device is the sculptor, Mr. Robert Paine, whose art education was received in Chicago and New York. He is now engaged in supervising the enlargement of sculpture at the Panama-Pacific Exposition.

It was while Mr. Paine was an assistant of Augustus St. Gaudens that he began to work on the problem of enlargement. The old method was very slow, consequently expensive; it was difficult to find men who could use it successfully; even in the most skillful hands the process did not produce an enlargement in the exact proportions of the original figure. It was approximate at best. Sculptors had suffered much because of poor enlargements. One large figure was actually abandoned by St. Gaudens.

The layman does not realize how many chances there are for the sculptor's work to be spoiled after the clay model leaves his hands. The plaster molder may alter it—then the enlargement may be unsuccessful and again the plaster molder has his turn and finally the stone carver. It is very different from the old time when one man alone saw the work through from start to finish—from the conception of the idea to the completed marble. The "action" of the statue is so important and so difficult to reproduce by the old method that if for no other purpose than building up the armature the pointing machine is invaluable.

By the old method about fifty points could be set by one man in a day—with the pointing machine one thousand may be placed. Moreover, if the two men (one

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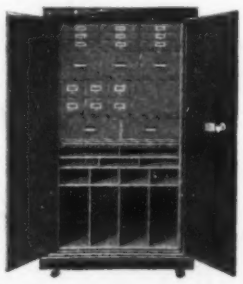

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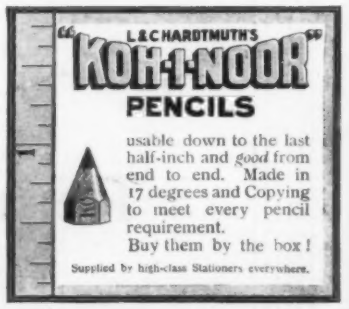

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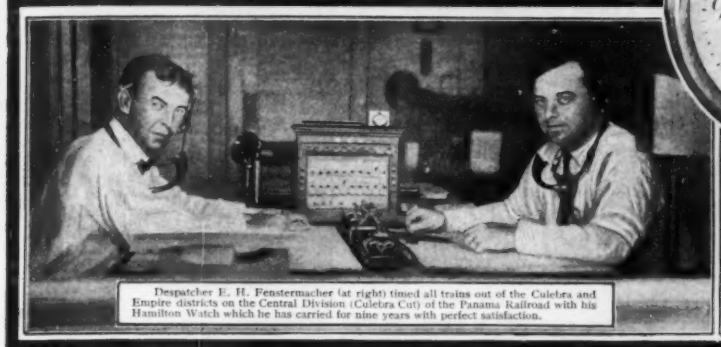

Despatcher E. H. Fenstermacher (at right) timed all trains out of the Culebra and Empire districts on the Central Division (Culebra Cut) of the Panama Railroad with his Hamilton Watch which he has carried for nine years with perfect satisfaction.

Panama Canal, Culebra Cut, Gold Hill on the left, Contractors' Hill on the right. This picture, taken August 21, 1913, shows the completed canal prism where many of the slides occurred.

The Hamilton Watch and the Panama Canal

Mr. Fenstermacher timed and supervised from 260 to 350 dirt train movements each day of eight hours to and from the canal prism on a *single track*. An absolutely reliable watch was necessary to avoid wrecks and tie-ups, and his *Hamilton* did the work.

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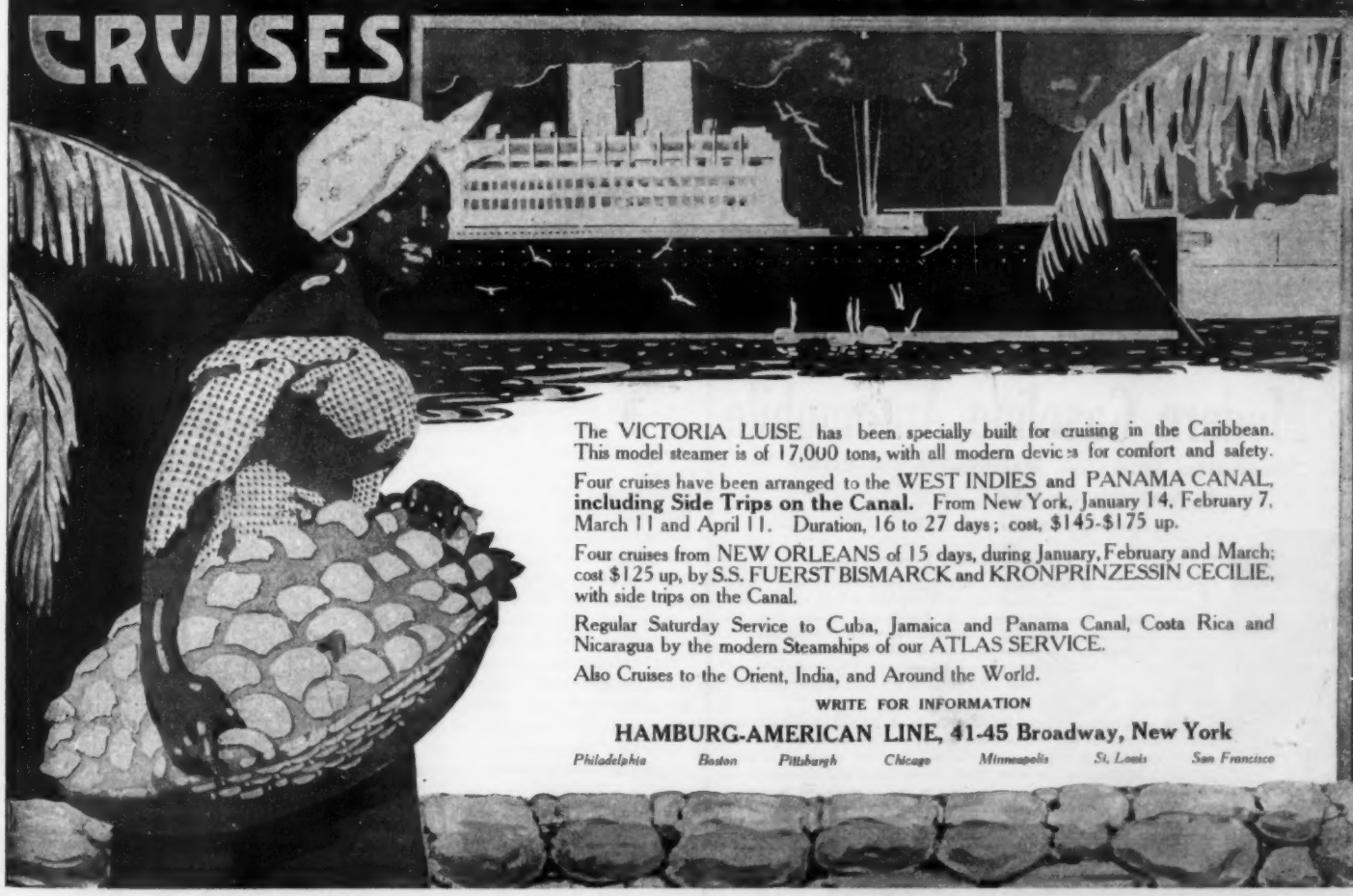

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Future Prices of Commodities and Materials

(Concluded from page 437.)

personal effort, the yearly agricultural, mineral, and manufacturing output could be doubled, it would raise the rate of interest; seeing that by investing in production, the capitalist could earn twice as much as by lending under present circumstances. Similarly, if a means were invented which would enable two payments of money to be made with the same capital and in the same time in which only one payment can now be made, the effect on prices expressed in money would be the same as though the whole sum of money in circulation were doubled. It would infallibly operate on prices as did the issues of green-backs half a century ago, or as we feared the full-tender silver dollars would operate in 1872, when we restricted their mintage and (for a time) limited their tender.

It is believed that the cause has been found: not that it has doubled, or is going to double prices; but that it has seriously affected them, especially in this country; and is likely to affect them still further in future. The cause is the telegraph and telephone lines, which, owing to their enormous and exceptional increase in the country, have multiplied the means of communication between distant persons in business, enabled a single dollar of money or of credits reduced to the velocity of money, to do as much work in making payments as formerly one and a third, or one and a half, dollars could do: thus rendering dollars superabundant and begging for exchange or investment at necessarily enhanced prices for commodities. For be it observed that not only have commodities risen: so also has the rate of interest for permanent loans of money.

If we divide commodities into ten classes, arranged in the order of their marketability, it will be found that they do not rise simultaneously, but one after another, somewhat as follows: 1, shares in industrial enterprises, with international market; 2, shares, with national market; 3, shares, with local market; 4, staples, cotton, wool, tobacco, etc.; 5, merchandise, contractors' materials, etc.; 6, fabrics, machinery, etc.; 7, real estate; 8, skilled labor; 9, unskilled labor; 10, professional services. When the cause of the rise has expended its force, should it be succeeded by opposite influences, for example, a shortage of the current gold supplies, such as that which occurred in 1825-45, the fall of prices would take place in the same order. Fig. 1 shows both rise and fall.

If (for the sake of further illustration) the increased velocity of money had the effect to double prices in 60 months (5 years) and was followed by circumstances tending to restore them to their former level, then it would be seen that while some prices were falling, due to the assumed gold shortage, others, from the influence of the previous "velocity," would still be rising. This curious movement is shown in Fig. 2. Though the cause was not suspected, the fact appears in Tooke's "History of Prices."

This phenomenon, the velocity of money, was observed by John Locke, Henry Thornton, John Stuart Mill, and numerous other political economists of the past two centuries, though owing to the imperfection of data, none of them essayed to compute it even approximately. In 1894 it was computed for the United States by the writer at about two transfers of the dollar per week for combined money and credits, after the latter had been reduced to the velocity of money. It is now probably one transfer in three days; money being much more active, while credits, as shown

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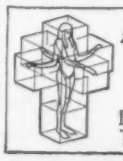

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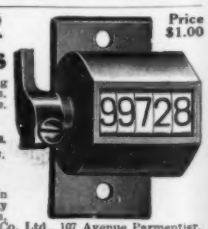

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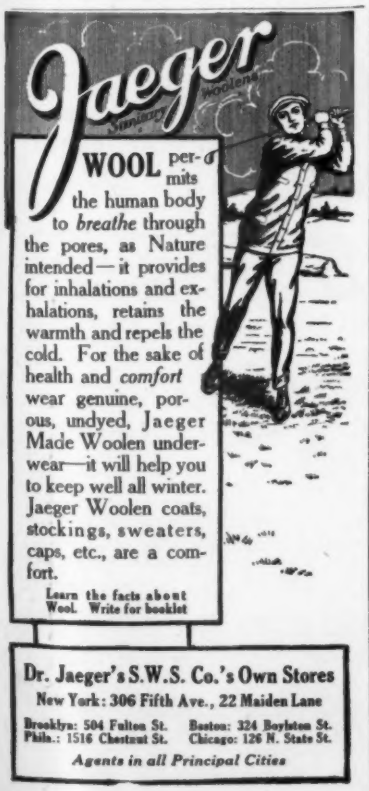

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by the bank returns, have been subjected to restriction.

The stage coach and post office began it; the railroads continued it; the general introduction of steam increased it; the bank check, the clearing house, the telegraph and telephone lines have enormously augmented it; and the auto and flying machine may still further enhance it. In the western world money is no longer pieces of gold or silver to be weighed in the balance. Like Icarus, it has taken wings: it is now a mechanism which operates with the speed of lightning, electrifying and vivifying everything it touches. Such is the evident cause of the rise. Nor has it yet expended its force.

Oilcloth and Linoleum Industry

STATISTICS of the oilcloth and linoleum industry in the United States for 1909 are presented in detail in a bulletin soon to be issued by Director Harris of the Bureau of the Census, Department of Commerce. It was prepared under the direction of W. M. Steuart, chief statistician for manufactures.

This industry embraces establishments engaged primarily in the manufacture of floor coverings of oilcloth and linoleum (including cork carpet) and of enameled oilcloth, including table, shelf, and upholsterers' oilcloth, etc. Some of the establishments in the industry also manufacture buckram and burlap wall coverings.

Value of Products.

The value of products of establishments in the United States engaged in manufacturing oilcloth and linoleum in 1909 was $23,339,022, two thirds of which ($15,550,101) represented the cost of materials. The value added by manufacture (value of products less cost of materials) was, therefore, $7,788,921. The oilcloth and linoleum branch of the industry contributed 67.8 per cent of the total value of products reported for the industry as a whole and 72.7 per cent of the value added by manufacture. Of the total number of wage earners, 81.2 per cent were reported by the floor oil-cloth and linoleum branch.

The manufacture of oilcloth in the United States commenced about 1807. Statistics for the industry first appeared in the census reports for 1810, when one establishment in Philadelphia was reported as engaged in "floor cloth stamping." Its product was gvien as 1,500 yards, valued at $3,000.

The industry has shown continuous and substantial increases for the entire period since 1869 with the single exception of the decade 1879-1889, when slight decreases appeared in several of the principal items shown. The value of products for 1909 was more than five times that in 1869, and the number of wage earners increased 268.6 per cent between those years. The value of products and cost of materials more than doubled during the decade 1899-1909, the percentage of increase in each case being slightly less than during the preceding decade. The number of wage earners increased 61 per cent and the amount paid in wages 73.5 per cent from 1899 to 1909.

Imports and Exports.

In 1899 the imports of oilcloth and linoleum amounted to only 416,658 square yards, valued at $216,210, but increased steadily from year to year until 1907, when 7,109,067 square yards, valued at $2,313,772, were reported. From 1907 to 1910 the imports decreased to 4,848,615 square yards, valued at $1,834,640.

The value of the exports of oilcloths has also increased with each successive year, with the single exception that there was a decrease in 1909 as compared with 1908, and was more than four times as great in 1910 as in 1898.

A Number of Brake Shoe Patents.—Clifton D. Pettis of Chicago, Ill., has taken out a series of eight patents numbered from 1,065,714 to 1,065,721, inclusive, for brake shoes. The inventions relating particularly to shoes having cast metal body portions and ductile metal backs, various constructions being illustrated and described in the different patents.

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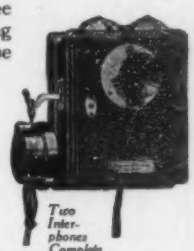

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(12868) C. M. B. asks: Will you please tell me in your question column how long ago was the first successful talking machine made? Also, how long ago was the first successful moving talking picture machine made? A. Edison invented the phonograph in 1876-77. It could hardly be called a successful machine, since its reproduction was very indistinct and faulty. It was the foundation for the wonderful results which have since been attained. The talking moving pictures were brought out in New York last winter.

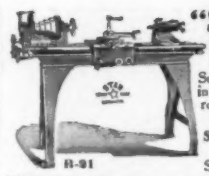
(12869) M. G. asks: Kindly let me know what you think was the cause of the Dayton floods last spring. Do you think that using extravagantly the trees at the sources of the Ohio and Alleghany rivers had anything to do with it? A. A very unusual rainfall was the immediate cause of the Dayton flood. If the country had been well covered with forests the water would not have run off so rapidly and the flood would not have been so severe. The rainfall would probably have been just the same, but the water would have been held back in the softer ground of the forest and in the shade of the trees so that the country down the stream would not have suffered so much. It is not believed that forests affect the actual amount of rainfall, but they do retard the flow of the water from the area covered by them.

(12870) H. B. T. asks: Will you please advise what aluminium is, what it is made from or of, and what the process is? Is electricity used in the making, and if so how? A. Aluminium is a metal just as iron, lead and tin are metals. It is also a simple elementary substance, just as the metals mentioned above are simple elements. It is very abundant in the earth, being the third element in quantity. Oxygen is the most abundant. Nearly half of the entire earth is oxygen. A little more than a quarter of the earth is silicon. After these come aluminium, of which nearly 8 per cent of the earth is composed, and then iron, of which nearly 5½ per cent of the earth is composed. Over seven-eights of the entire materials of the earth are these four elements. All clay contains a large proportion of aluminium. However, aluminium is not prepared from clay. It has not been possible to obtain it from clay as cheaply as from bauxite and cryolite. These minerals are reduced in an electric furnace and the aluminium is separated from the other substances by the intense heat of the furnace.

(12871) J. H. K. asks: Will you kindly inform me whether it is a fact that certain magnetic coils will repulse aluminium? I have been told that a sheet of aluminium was held about eight inches above a magnetic coil by the force of this repulsion, but was given no definite description of the apparatus. I also read in one of the popular technical magazines of a proposed railway which was to be operated by virtue of this repulsive force. This of course was a dream of some inventor, but it has caused me to think that this repulsion must be a recognized fact, and if so I would be pleased to learn where I may find data on such phenomenon. It may be possible that the subject has been discussed in one of the SCIENTIFIC AMERICAN SUPPLEMENTS, in which case I would appreciate learning the number of the same. A. An alternating current in an electromagnet will produce repulsion of any metal excepting iron or steel, that is, of any non-magnetic metal. Copper, aluminium, tin and others will be thrown out of the field or away from the magnet with considerable force, but it would hardly be practicable to run an electric car with this force. Many experiments with these currents are given in our SUPPLEMENT. We name Nos. 762, 763, 927, 1184, price ten cents each.

(12872) H. E. Z. asks: I wish to ask if it is known to what depth water sinks into the earth, for instance, underneath swamps and ponds. A. We do not know to what depth water sinks into the earth. Certainly not deeper than to the point where the earth is at the temperature of boiling water. In many places this is very near the surface, such as the neighborhood of hot springs and volcanoes. But the water does not sink far down in swamps and beneath ponds; they have water-tight bottoms. The swamps and ponds would not be there if water could sink away. Usually there is a layer of clay in such places, which holds the water.

(12873) T. A. C. asks: A glass tube one foot long is closed at one end, filled with mercury as in Torricelli's experiment, but instead of resting on the bottom of the vessel, it is suspended from one arm of a balance. Does it weigh more than before it was filled? A. We do not see that it makes any difference whether the tube be hung open end up or down from the arm of the balance, all its weight is suspended from the balance, and the same weights will be required to weigh it. A tube must be so fine as to be nearly capillary for this experiment, and the mercury is held up by the air pressure on the open end. If the tube were closed at the bottom the air pressure would be the same on the bottom as when it is open, and so the weights would be the same.



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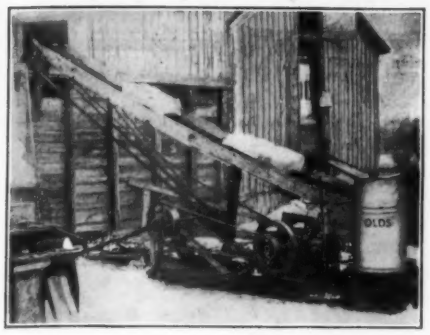

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